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THESIS

CROWDS AS COMPLEX ADAPTIVE SYSTEMS: STRATEGIC IMPLICATIONS FOR LAW ENFORCEMENT

by

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March 2016

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Law enforcement attempts to control unruly crowds have come under increased scrutiny in light of recent unrest in Ferguson, Missouri; Baltimore, Maryland; and other locales across the United States. Resultant criticism is forcing law enforcement agencies nationwide to review their civil-unrest policies. Crowd behavior resulting from police actions is an important component of crowd control. Viewing crowds from a systems perspective, as done in this thesis, provides powerful new insights to help law enforcement assess potential crowd behaviors. Through this new awareness, this thesis makes recommendations regarding policies, training, and equipment that law enforcement can use to make better-informed decisions related to crowd control.

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CROWDS AS COMPLEX ADAPTIVE SYSTEMS: STRATEGIC IMPLICATIONS FOR LAW ENFORCEMENT

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ABSTRACT

Law enforcement attempts to control unruly crowds have come under increased scrutiny in light of recent unrest in Ferguson, Missouri; Baltimore, Maryland; and other locales across the United States. Resultant criticism is forcing law enforcement agencies nationwide to review their civil-unrest policies. Crowd behavior resulting from police actions is an important component of crowd control. Viewing crowds from a systems perspective, as done in this thesis, provides powerful new insights to help law enforcement assess potential crowd behaviors. Through this new awareness, this thesis makes recommendations regarding policies, training, and equipment that law enforcement can use to make better-informed decisions related to crowd control.

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EXECUTIVE SUMMARY

The manner in which law enforcement responds to crowd control issues has changed over the years. From escalated force models to models emphasizing negotiations with crowds, the field of crowd control continues to evolve. Much of this evolution is due to increased public scrutiny of law enforcement tactics following widely publicized events, such as the 2014 riots in Ferguson, Missouri, and the 2015 riots in Baltimore, Maryland.[1] Through widespread mass media and social media exposure, these events and others like them have been catapulted into the collective consciousness, laying bare police crowd-control tactics for all to see. Legislators around the United States have acted upon calls for reform after widespread claims of civil rights violations and heavy-handed police tactics.[2] In light of this increased scrutiny and calls for reform, police agencies must reassess their methods of policing, especially in the field of crowd control.

This thesis contends that viewing crowds from a systems perspective is an alternative way to understand crowd behavior. The systems perspective views crowds in a holistic manner, encompassing the crowd as a whole rather than an aggregation of individuals. With this view, law enforcement can better understand how stimuli introduced into one part of the crowd can induce adaptive behaviors in the overall mass. Understanding the strategic implications of crowd adaptability on police operations allows law enforcement to prepare strategically for a response before the event occurs.

The particular systems perspective employed in this thesis is that of *complex adaptive systems.* Complex adaptive systems are systems in which the elements initially interact in a chaotic or nonlinear way.[3] That is to say, communications between system elements do not follow a logical, linear path from one element directly to another.

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[1] Michael S. Schmidt and Matt Apuzzo, "F.B.I. Chief Links Scrutiny of Police with Rise in Violent Crime," *New York Times*, October 23, 2015, http://www.nytimes.com.

[2] David A. Lieb, "Activists Seek More Reforms, One Year after Ferguson Uproar," CBS St. Louis, August 2, 2015, http://stlouis.cbslocal.com/2015/08/02/activists-seek-more-reforms-one-year-after-ferguson-uproar/.

[3] Michael Agar, "Complexity Theory: An Exploration and Overview Based on John Holland's Work," *Field Methods* 11, no. 2 (November 1, 1999): 104, doi: 10.1177/1525822X9901100201.

Instead, communications pass through multiple elements before reaching a destination. Over time, these multiple elements tend to self-organize in a manner that leaves them vulnerable to dramatic, large-scale changes resulting from minor stimuli. This change results in unanticipated emergent behavior on the part of the system. Once emergent behavior occurs, complex adaptive systems further adapt their behavior to changes in the environment through a learning process known as *metis*.[4] Once learning is achieved, continued emergent behavior results from the feedback loop established between metis and emergence.

This thesis applies the complex adaptive systems perspective to analyze case studies involving civil unrest. The case studies include the 2014 riots in Ferguson, the 2004 unrest in Boston following the World Series; and the disturbance at the 2014 Keene, New Hampshire, pumpkin festival. These case studies present events of varying size and complexity, establishing the viability of the systems perspective in differing contexts through critical analysis.

A number of recommendations regarding policy, training, and equipment are presented in this thesis. Regarding policy, police agencies must first establish crowd control policies, if they are not already in place. Second, crowd control policies must establish a decentralized model of decision making in order to quickly respond to adaptations in crowd behavior. Third, crowd control policies must not fall prey to unrealistic assumptions based upon past thinking. Policy must also establish training for all line and supervisory officers engaged in crowd control operations. Next, it is recommended that training be mandated for all command-level personnel, up to and including the agency head. The final recommendation is to create the position of strategic/tactical social media officer. This officer will monitor social media and analyze its contents in order to provide real-time, actionable intelligence to incident commanders in crowd control matters.

Training recommendations include annual training for all officers potentially involved in crowd control operations. Primary and specialty crowd response teams should

[4] Rafe Sagarin, *Learning from the Octopus: How Secrets from Nature Can Help Us Fight Terrorist Attacks, Natural Disasters, and Disease* (Jackson, TN: Basic Books, 2012), 43.

train at least quarterly. Recommendations also include certifying crowd control officers annually through written and practical examination, similar to the British College of Policing model for crowd control training. Training must also provide an understanding of complex adaptive systems so officers can better understand how their actions may affect an entire crowd. In addition, officers must be trained to be flexible through decentralized decision making in their response to crowd control. This can be accomplished by training officers to recognize changes to the environment affecting crowds, and to learn to solve problems created by emergent crowd behaviors. Finally, training must make officers aware that crowd elements may be trained in thwarting police tactics at crowd control.

With respect to equipment, recommendations include maximizing force multiplier effects through the proper deployment of specialized crowd control equipment. Officers must be trained and certified annually to employ specialized crowd control equipment at appropriate times so as not to provide a stimulus that causes further unrest. Manufacturer's training curricula in the use of specialized equipment must be vetted to ensure it comports with current legal and ethical standards of use. Law enforcement must procure necessary equipment to defeat crowd-deployed devices that hinder police control efforts. The final recommendation is to equip the strategic/tactical social media officer recommended in policy with the necessary equipment to effectively monitor social media.

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I. INTRODUCTION

> History informs us that a critical incident can happen anywhere and at any time.
>
> —United States Department of Justice, *After-Action Assessment of the Police Response to the August 2014 Demonstrations in Ferguson, Missouri*

A. PROBLEM STATEMENT

Police control over unruly crowds, especially related to tactics and abuses of power, has generated much examination in recent years. The police response to the 1999 World Trade Organization protests in Seattle, Washington, came under scrutiny; city police, it was argued, were not prepared for the crowds, and large parts of the city shut down as protesters clogged thoroughfares.[1] In Columbus, Ohio, the police department moved in aggressively with tear gas and armored vehicles against a crowd of raucous, yet otherwise peaceful, celebrants in the hours after Ohio State University won the 2014 national football championship.[2] After heavy criticism, the department later admitted mistakes were made in their handling of the crowd.[3]

The issue of policing unruly crowds has become especially salient since violence rocked the cities of Ferguson, Missouri, in 2014 and Baltimore, Maryland, in 2015.[4] In Ferguson, more than two weeks of violence and destructive rioting occurred after the police shooting of Michael Brown, a black teenager who attacked a police officer during

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[1] "World Trade Organization Protests in Seattle," Seattle.gov, accessed February 26, 2016, http://www.seattle.gov/cityarchives/exhibits-and-education/digital-document-libraries/world-trade-organization-protests-in-seattle.

[2] "Police Pepper Spray, Tear Gas Celebrants," YouTube video, published by "TheColumbusDispatch," January 13, 2015, https://www.youtube.com/watch?v=jDHuQ8pylmA.

[3] Jim Letizia, "Police Admit Crowd Control Mistakes Following OSU National Title Win," WCBE, March 6, 2015, http://wcbe.org/post/police-admit-crowd-control-mistakes-following-osu-national-title-win.

[4] "Michael Brown Shooting: Vigil for Dead Teen Turns Violent," CBS News, August 11, 2014, http://www.cbsnews.com/news/michael-brown-shooting-vigil-for-dead-teen-turns-violent/; "Baltimore Riot," CNN, accessed October 27, 2015, http://cnnuslive.cnn.com/Event/Baltimore_Riot?Page=0.

an encounter subsequent to a strong-arm robbery.[5] Civil unrest was pervasive; groups of protesters marched through the streets of the city, inciting violence and unrest despite the best efforts of clergy and other community members to stop them. News networks and social media spread stories and images of the unrest, which helped to spark affinity demonstrations in cities around the country.[6] After the Michael Brown shooting, the police use of military-style weapons and vehicles came under scrutiny by the public and the United States Justice Department, at a time when the use of such equipment was being questioned in light of the perceived militarization of law enforcement.[7]

In Baltimore, the in-custody death of Freddie Gray, a black man arrested for possession of an allegedly illegal knife, ignited several days and nights of violent protests.[8] While many were protesting what they perceived to be a racist justice system, the Baltimore Police Department was the target of their ire. As a result, a number of police officers were injured and several police vehicles torched. During the rioting, protesters were injured and commercial properties destroyed. As in Ferguson, this occurred despite the best efforts of community leaders to quell the unrest.[9]

How a crowd adapts its behavior in response to police actions is an important issue in policing. Despite the appearance of many independent actions on the part of protesters in the aforementioned events, looking at them as systems—rather than as collections of independent elements—can reveal insights into the forces guiding crowd adaptability. For example, the emergence of social media as an instant communications tool for protesters—one that allows like-minded people to congregate online to learn

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[5] "Ferguson Police Release Surveillance Video Related to Michael Brown Shooting," CBS News, August 15, 2014, http://www.cbsnews.com/videos/ferguson-police-release-surveillance-video-related-to-michael-brown-shooting/.

[6] Amanda Holpuch, "Ferguson Solidarity Protests Spread to Dozens of Cities Nationwide," *Guardian*, August 21, 2014, http://www.theguardian.com/.

[7] Devlin Barrett, "Justice Department to Investigate Ferguson Police Force," *Wall Street Journal*, September 4, 2014, sec. U.S., http://www.wsj.com/.

[8] Scott Calvert, "Baltimore Prosecutors Say Freddie Gray Arrest Was Illegal before Finding Knife," *Wall Street Journal*, May 19, 2015, sec. U.S., http://www.wsj.com/.

[9] Rachel Lippmann, "Four Days on, Activists Look for Ways to Channel Frustration over Michael Brown's Death," St. Louis Public Radio, August 12, 2014, http://news.stlpublicradio.org/post/four-days-activists-look-ways-channel-frustration-over-michael-browns-death.

from one another—has made crowds more adaptable than ever. This adaptability has also made crowds more unpredictable and difficult for law enforcement agencies to manage. Crowd adaptability is causing police to rethink traditional methods of crowd control, which are less effective in fluid situations. Within that parameter is a knowledge gap, and subsequent questions regarding crowd adaptation and its implications on police strategy in dealing with unruly crowds.

Police commanders often have limited resources in crowd control incidents. Understanding the forces that drive crowd adaptation, and how that adaptation changes preconceived responses, will allow police commanders to better anticipate resource allocation issues. This understanding will also provide a basis for policy decisions about crowd control approaches. Considering a major paradigm shift in how police view crowd control situations fills a gap in literature on the topic. Due to potential constitutional rights and pubic order ramifications, this shift cannot be implemented without the sound methodological research and analysis presented in this thesis.

At the strategic level, crowd control operations in emergent conditions must conform to the dual police role of ensuring free speech rights while simultaneously maintaining the peace. Issues of policy, training, and equipping for crowd control must be in line with an agency's strategic objectives. These are among the main issues modern police agencies must consider in the realm of crowd control.

B. RESEARCH QUESTION

This thesis asks: What are the strategic implications of crowd adaptability on police policy, training, and equipment resulting from crowd control situations? To answer this question, this thesis employs a systems perspective in viewing crowds. While there are a number of psycho-social theories to explain crowd behavior—game theory, emergent norm theory, and social identity theory among them—the existing theories fail to view crowds as systems during crowd control events. While these theories view crowds from the micro-level of individuals, viewing them as systems may readily explain how the interconnectedness of the individual elements influences group behavior. Viewing a crowd as a system also allows law enforcement officials to observe the

cumulative effects of multiple actions on the part of crowd members. When one thinks of a system, one may envision seamlessly integrated elements working in linear, coordinated fashion to achieve some end. If members are not coordinated, and their interactions are chaotic, their actions are nonlinear and more complex, as revealed in the case studies to follow. Over time, patterns emerge as crowds adapt their behavior toward achieving goals. How those complex interactions congeal into unified thought and behavior is an area worthy of exploration through a systems framework, specifically a *complex adaptive systems* framework.

The crux of this thesis views the role adaptability plays in the interactions between crowds and the police. By employing a systems approach, this work contributes to the knowledge base surrounding crowd control, and provides a foundation upon which decisions may be made by police commanders. While considering adaptability's role in these encounters, there are a number of ancillary questions to be asked. Chief among these are questions regarding complex adaptive systems themselves. What defines a crowd as *complex*? How is adaptation defined in this context? What qualifies a crowd as a system? What role does crowd adaptation play in how crowds and police respond to one another? What strategic implications does crowd adaptability present for police in responding to future crowd control events? These are among the questions that must be answered if we are to understand the interplay between crowds and law enforcement.

C. METHODOLOGY

The research methodology for this work is qualitative in nature. According to Lauren Wollman of the Naval Postgraduate School, quantitative research may shed light on what people are doing, but qualitative-based research is more adept at explaining why they do it.[10] In the social sciences, the myriad factors contributing to human behavior do not lend themselves to exploration within the rigid parameters of quantitative frameworks. While quantitative research of a riotous crowd can provide hard numbers of windows broken, arrests made, etc., it cannot delve into the inner systemic workings of a

[10] Lauren Wollman, "Qualitative Research," Naval Postgraduate School video, Summer 2012, sec. 3, https://www.chds.us/coursefiles/research/lectures/research_qualitative_methods/player.html.

crowd. While not perfect, a qualitative approach is more adept at exploring group behavior in light of the many influencing factors.[11]

While the methodology in this work is qualitative, the research paradigm is exploratory in nature. That is to say, it examines issues largely unexplored or not well defined, such as viewing crowds as complex adaptive systems.[12] The nature of such systems often defies rigid definition, therefore lending itself to new avenues of exploration and inquiry. Within these avenues, there lie potential new ways to see and understanding crowds confronted by law enforcement. This paradigm is useful in exposing patterns, and would prove beneficial in recognizing patterns indicative of emergent system characteristics.[13]

The research methodology for this work involves rigorously exploring relevant literature. In the field of complexity—in particular, complex adaptive systems—research revolves around works by noted authorities such as Per Bak, Stephen Wolfram, and Karen Tesson, including the researchers at Complexity Lab, and the Santa Fe Institute, both leading institutions in the study of complexity theory. This author also viewed a number of video recordings from Complexity Lab and the Santa Fe Institute that explained complexity theory and its application to systems.

Also included in the methodology are case studies of crowd control situations faced by police, where the crowds displayed characteristics indicative of complex adaptive systems. Data sources included both print and electronic news coverage and video of civil unrest. Print and video coverage not from a recognized news agency were corroborated by a second authoritative source to ensure validity. For videos, this corroboration technique keeps with "social media video analysis," an analytical technique developed by Stephen Max Geron at the Naval Postgraduate School.[14] In addition,

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[11] Wollman, "Qualitative Research," sec. 6.

[12] Lauren Wollman, "Research Paradigms," Naval Postgraduate School video, accessed February 5, 2015, sec. 7, https://www.chds.us/coursefiles/research/lectures/research_paradigms/player.html.

[13] Wollman, "Research Paradigms," sec. 7.

[14] Stephen M. Geron, "21st Centruty Strategies for Policing Protests: What Major Cities' Responses to the Occupy Movement Tell Us about the Future of Police Response to Public Protest" (master's thesis, Naval Postgraduate School, 2014), xvi.

official written police reports and manuals were utilized, when possible, to gain insight into how police dealt with crowd control events. Manuals and videos available to protesters are also examined for salient data regarding adaptive responses to police actions. Online manuals such as "Warrior Crowd Control and Riot Manual," and "Bodyhammer: Tactics and Self-defense for the Modern Protester," as well as online manuals from activist groups like the Ruckus Society are among those examined.

A final source of data is the author's own experiences over thirty years as a police officer. These experiences in numerous crowd control events have given him valuable insights into interactions between crowds and the police. That experience has exposed gaps in understanding interactions between crowds and law enforcement. Taking a systems approach to explore those gaps provides an alternative perspective to popular social-psycho theories.

While providing first-hand experience can prove valuable, it is not without its pitfalls. Any semblance of bias would jeopardize the credibility of the information, and call into question the validity of this research. Therefore, the author has taken great pains to corroborate career experiences with other resources whenever possible.

D. THESIS OVERVIEW

This thesis examines literature on civil disorder, crowd behavior, crowd control, police response to civil unrest, and the concept of complex adaptive systems. Varied sources ranging from official government documents to media reports and underground protester publications provide a well-rounded view of the subject matter. Complex adaptive systems are explained after the literature review. This thesis provides a basic understanding of such systems by explaining their origin and characteristics, and how they are applied to the study of human behavior, specifically in crowd control contexts.

Three case studies combining evaluative, exploratory, and descriptive methods of research are presented, followed by analysis of each. The cases featured are the riots in Ferguson, Missouri, in 2014; unrest in Boston, Massachusetts following the 2004 World Series; and the civil disturbance in Keene, New Hampshire during their 2014 pumpkin festival. The role of crowd adaptability as seen in the case studies is of paramount

importance to this research. No crowd in a civil unrest environment is static. They move, interact, and adapt to inputs from the environment. When viewed holistically as a system, not as individual agents, the behavior of a crowd, and thus its adaptability, is more easily envisaged. Analysis of each case study is combined to establish commonalities. By establishing common themes among the cases, consistent patterns of behavior inherent in complex adaptive systems are sought. These patterns give rise to better understanding of crowd behavior by the police, enabling them to better prepare for crowd control through policy, training, and equipment considerations.

This thesis goes on to examine the strategic implications crowd adaptability has on policing crowds. The thesis provides police commanders with an understanding of the adaptive dynamics in crowd behavior, and what crowd adaptation means to overall police operations—not from a tactical perspective, but from future policy, training, and equipment perspectives.

Finally, recommendations are provided to better prepare law enforcement agencies for policing unruly crowds. Making policy more amenable to crowd adaptations and officer training for civil unrest are addressed. Recommendations are also provided for specialized equipment used in crowd control events.

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II. LITERATURE REVIEW

On January 20, 2015, heavily armed police clad in heavy riot-protective clothing and gas masks arrived on the scene in Columbus, Ohio. Within a short time, without warning, they began spraying the crowd with large containers of pepper spray, sending those present scattering in panic. Meanwhile, officers on horseback arrived, aggressively pushing the crowd back while small groups of officers continued to spray the crowd. All the while, tear gas canisters belched thick white clouds of choking tear gas into the air.[15]

One could reasonably presume, given these actions, the police in Columbus were responding to a large, violent riot. What they were in fact responding to was a large, non-violent—albeit raucous—gathering of revelers celebrating the Ohio State Buckeyes football team's 2015 national championship win.

Watching video of the incident provided by the *Columbus Dispatch* newspaper, one must wonder if the police response was proper given the dynamics of the crowd. Was this heavy-handed approach necessary? Were there alternatives to the tactics used? Community anger directed at the Columbus Police Department following the incident forced the department to consider changes to their crowd control policies in advance of the next football season.

The purpose of this literature review is to analyze extant literature and examine what sources are available, and what is missing in the research of police interactions with crowds displaying a propensity for unrest and violence. Areas where a convergence of opinion exists, along with areas of disagreement will be highlighted, providing readers with information to objectively view the data. To do this, the review focuses on the current knowledge base and gaps in six sections: civil unrest, crowds as complex adaptive systems, the evolution of police crowd control practices, strategic considerations for police, crowd adaptation, and a conclusion summarizing the overall findings. The first section, civil unrest, examines research identifying the different types of crowd situations

[15] Josh Jarman and Jim Woods, "Tear Gas Disperses Revelers around Campus after Ohio State Win," *Columbus Dispatch*, January 13, 2015, http://www.dispatch.com.

faced by police. It concludes by examining literature revolving around psycho-social theories of why crowds behave the way they do. Examination of such theories provides a look at commonly accepted theories of crowd behavior, and provides a counterpoint to viewing them in a systems framework.

The second section of this literature review considers research identifying unruly crowds as complex adaptive systems. This holistic approach will provide new insight into crowds by viewing them as systems instead of aggregations of individuals. To provide ease in understanding, metaphors will be drawn from biological systems in nature which exude properties of complex adaptive systems.

Section three examines the body of knowledge pertaining to research on police response to crowd control issues, and how that response has adapted over time. It will seek out what is known about the origins of police crowd control policies, procedures, and their effectiveness. The metamorphosis of police methods using widely accepted paradigms on crowd control will be presented through available sources.

Section four seeks to discover research literature on how crowds have adapted to police methods of controlling them. Open source literature available to demonstrators is utilized to explore what is known about their philosophies and tactics in adapting to the police response.

A summary of findings from the research literature comprises the sixth section. A recap of each section synthesizes findings into a concluding statement about the type and quality of the literature, its validity and salience with respect to the topic, what is known, and yet to be discovered about the subject.

A. CIVIL UNREST

There is a large body of scholarly, technical, and popular work available in the study of civil disorder. It is not surprising that varying definitions and terms are used to describe what are essentially similar events. *Civil disorder* is defined under 18 U.S. Code §232 (Definitions) as “any public disturbance involving acts of violence by assemblages of three or more persons, which causes an immediate danger of or results in damage or

injury to the property or person of any other individual."[16] *Civil disturbance* is defined as "group acts of violence and disorder prejudicial to public law and order," while a *riot* is defined as "a violent disturbance of the public peace by a statutorily defined number of people assembled for a common purpose."[17]

Research indicates there are varying degrees of civil unrest necessitating categorization of the phenomenon in much of the literature reviewed for this document. According *Managing Civil Action in Threat Incidents,* a student manual provided by the Center for Domestic Preparedness, there are four categories of civil unrest; "civil disobedience—nonviolent refusal to obey civil laws, *protest*—an organized demonstration of disapproval, civil disturbance—group acts of violence and disorder prejudicial to public law and order, riot—a violent disturbance of public peace by a statutorily defined number of people assembled for a common purpose."[18]

As in the United States, the police services in Canada often find themselves maintaining public order among crowds. The Toronto Police Service has established four categories of crowds in their *Public Order Unit Student Manual.* A crowd lacking unity or common goals and that acquiesces to police requests—such as a crowd gathering to watch EMTs work—is deemed a *casual crowd.*[19] A *cohesive crowd* is one that has come together for a specific reason, such as a sporting or political event. Members of this crowd do not necessarily depend upon each other, but do unite around a purpose. The potential exists for a cohesive crowd to become violent given an adequate precipitating factor.[20] *Expressive crowds* are those characterized by a bond stemming from a common purpose, where leadership exists to help express sentiments about an issue. Expressive crowds are generally not violent. Political rallies, picket lines, and social action groups

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[16] Crimes and Criminal Procedure, 18 U.S.C. § 232 (2016).

[17] Center for Domestic Preparedness, "Managing Civil Actions in Threat Incidents," in *Command Student Manual* (Washington, DC: U.S. Department of Homeland Security, 2007), HRB-4.

[18] Center for Domestic Preparedness, "Managing Civil Actions."

[19] The specific manual referenced was utilized by the Toronto Police Public Order Unit while training the Kentucky State Police in public order policing during October, 2009. See Toronto Police, *Toronto Police Service Public Order Student Manual* (Toronto, Canada: Toronto Police Public Order Unit, 2009), 54.

[20] Toronto Police, *Toronto Police Service Public Order Student Manual*, 54.

are examples of such crowds.[21] The *aggressive crowd* is the most challenging of the four crowd categories.[22] This crowd derives motivation from strong feelings and unity of purpose. Often characterized by strong, militant leadership, it can turn violent with little warning. If properly managed, this category remains a crowd; if mishandled, the potential for rioting exists.[23] It was an aggressive crowd in Vancouver, British Columbia which exploded into violence in June of 2011 after the Vancouver Canucks lost the Stanley Cup finals to the Boston Bruins. Thousands of people turned violent in an alcohol-fueled rage after the loss.[24] Fights broke out in numerous locations and vandals targeted automobiles. One Twitter user posted, "Get ready for a riot Vancouver."[25] Although not considered a category of crowd, Toronto Police define a riot as a stage of crowd interaction. This stage of behavior is identified by tumultuous conduct involving five or more persons whose behavior obstructs police enforcement and causes injury to people and property.[26]

As varied are the categories of civil disorder, so are the triggers for their existence. While there is often some violence-inducing event, known as a *flashpoint*, that sets the wheels in motion for civil disorder, there are often deep-seated issues at the heart of civil unrest.[27] Such was the case in the unrest that rocked Baltimore, Maryland, in April of 2015. Freddie Gray's death was the flashpoint that brought the deep-seated issues to the fore. Some Baltimore residents cited poor job opportunities, improper healthcare, and police injustices as being the real reasons behind the rioting, while others

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[21] Ibid.

[22] Ibid.

[23] Ibid.

[24] John Furlong and Douglas Keefe, *The Night the City Became a Stadium: Independent Review of the 2011 Vancouver Stanley Cup Playoffs Riot* (Vancouver, British Columbia: Government of British Columbia, 2011), 3, http://www2.gov.bc.ca/assets/gov/law-crime-and-justice/about-bc-justice-system/inquiries/report.pdf.

[25] Furlong and Keefe, *The Night the City Became a Stadium*, 19.

[26] Toronto Police, *Toronto Police Service Public Order Student Manual*, 50.

[27] James P. Bliss et al., "Crowd Reactions to Sublethal Weapons: Universal Triggers for Crowd Violence," *Proceedings of the Human Factors and Ergonomics Society Annual Meeting* 48, no. 22 (September 1, 2004): 2544, doi:10.1177/154193120404802207.

cited tension between classes.[28] Research by Dr. Michael Flamm of Ohio Weslyan University asserts civil disobedience is often the only recourse left to demonstrators denied fundamental freedoms when confronted by officials who often defied the law.[29] In addition to Flamm's contribution, volumes of research exist on how civil disorder is related to race, politics, and repression.

Other sources point to issues involving the police and the communities they serve as catalysts for unrest. In *Police Brutality: Opposing Viewpoints*, author Sheila Fitzgerald argues, "The errant behavior of a few abusive cops, even in absence of police shootings, can often destroy cooperative and strategic alliances between police and community."[30] Lacking cooperation and alliances can have a deleterious effect on relations with the police, which may lead to unrest. Mirroring those findings, Tracie Keecee and Michael Nila assert, "The need for law enforcement executives to forge trusting relationships with ethnic, racial, religious, and other diverse communities to achieve public safety objectives is critical."[31] Without such efforts, the legitimacy of police actions will be called into question when dealing with those groups.

Psycho-social theories on crowd behavior abound, and provide a counterpoint to the systems view of crowds espoused in this thesis. One noted scholar, Floyd Allport—the founder of experimental social psychology—posited that people act based on tendencies derived from conditioning.[32] He went on to say, "Collective behavior arises where there is a coming together of individuals who, owing to similarities of constitution,

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[28] Colleen Shalby and Joshua Barajas, "Here's the Real Reason People in Baltimore Are Protesting," PBS NewsHour, May 1, 2015, http://www.pbs.org/newshour/rundown/freddie-grays-death-baltimore-community-speaks-citys-future/; Kellan Howell, "Baltimore Riots Sparked Not by Race but by Class Tensions between Police, Poor," *Washingtion Times*, April 29, 2015, http://www.washingtontimes.com/news/2015/apr/29/baltimore-riots-sparked-not-by-race-but-by-class-t/.

[29] Michael W. Flamm, *Law and Order Street Crime, Civil Unrest, and the Crisis of Liberalism in the 1960s* (New York: Columbia University Press, 2005), 4.

[30] Sheila Fitzgerald, *Police Brutality: Opposing Viewpoints* (New York: Greenhaven Press, 2007), 25.

[31] Tracie Keesee and Michael J. Nila, "Fairness and Neutrality: Addressing the Issue of Race in Policing," *Police Chief Magazine* (March 2011): 34, http://www.nxtbook.com/nxtbooks/naylor/CPIM0311/.

[32] "Historical Figures in Social Psychology," Social Psychology Network, accessed January 16, 2015, http://www.socialpsychology.org/social-figures.htm.

training and common situations, are possessed of a similar character."[33] His point, metaphorically, was that birds of a feather flock together. Alternatively, Mancur Olsen's game theory provides a reductionist look at crowd behavior by viewing it in individualistic terms. He asserts individuals in a crowd tend to maximize utility by seeking the most benefit relative to costs, under conditions of "altered contingencies."[34] In other words, he states, "Where one perceives mass support, one will be more likely to pursue valued ends which one previously eschewed for fear of resistance or punishment by an out-group."[35]

Emergent norm theory is another psycho-social theory explaining crowd behavior. This theory accounts for social coherence of collective actions by combining symbolic interactionism with psychological research on group norm formation.[36] Muzafer Sherif and O.J. Harvey explain that group behaviors develop as a result of *emergent norms*.[37] Those norms come about from seemingly relation-less interactions between individual crowd members. Those are driven by what R.H. Turner and L.M. Killian call *keynoters*, who propose definite action, thereby eliminating collective ambivalence.[38] Emergent norm theory shares the characteristic of emergence with complex adaptive systems, yet it differs due to the presence of keynoters. Complex adaptive systems are covered in detail in Chapter III.

Social identity theory, created by Henri Tagfel and John Turner, is yet another theory to explain crowd behavior. Their work centered on how individuals identify with the world around them through their affiliation with groups. In *Social Identity and Intergroup Relations*, Tajfel and Turner stated, "Social identity of individuals is linked to their awareness of membership of certain social groups, and to the emotional and

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[33] Michael A. Hogg and Scott Tindale, *Blackwell Handbook of Social Psychology: Group Processes* (Hoboken, NJ: John Wiley & Sons, 2008), 189.

[34] Hogg and Tindale, *Blackwell Handbook*, 191.

[35] Ibid., 192.

[36] Ibid.

[37] Ibid..

[38] Ibid., 193.

evaluative significance of that membership."[39] The book goes on to say group behavior can be "casually dependent" upon shared social identifications in the group.[40] According to Fathali Moghaddam of the Naval Postgraduate School, social identity theory was developed to better understand inter-group relations, and has now been adapted by researchers to explain behavior in a wide spectrum of areas, including in crowds.[41] Stephen Reicher, of the University of St. Andrews School of Psychology in Scotland, writes, "A group is defined in terms of those individuals who identify themselves as members of the group. Unlike nearly all previous theoretical accounts, the crowd will be treated here in exactly the same manner as all other social groups; that is, a crowd will be defined as that set of individuals who share a common social identification of themselves in terms of that crowd."[42]

There are numerous other psycho-social theories related to crowd behavior. Though relevant, an in-depth examination of them exceeds the scope of this research. Although psycho-social theories can be useful in explaining crowd behavior, such theories do not consider crowds holistically as systems. By taking a systems view, this thesis reveals different perspectives to unlock potential secrets to crowd behavior.

B. CROWDS AS COMPLEX ADAPTIVE SYSTEMS

The framework used in this work to study crowds is that of complex adaptive systems. This framework allows the reader to gain a different perspective by viewing a crowd as a system rather than a collection of individuals. Though many texts explain complex adaptive systems, Serena Chan of the Massachusetts Institute of Technology succinctly describes them as many component parts characterized by complex behaviors, which emerge as a result of "nonlinear spatio-temporal interactions among a large

[39] Henri Tajfel, *Social Identity and Intergroup Relations* (New York: Cambridge University Press, 2010), 86.

[40] Tajfel, *Social Identity*, 36.

[41] Fathali Moghaddam (Naval Postgraduate School professor), in discussion with author, November 1, 2015.

[42] Tajfel, *Social Identity*, 68.

number of component systems at different levels of organization."[43] Roy Eidelson defines such a system as "a large collection of diverse parts interconnected in a hierarchical manner such that organization persists or grows over time without centralized control."[44] What Chan and Eidelson are saying is, although there is a large collection of unrelated elements devoid of central control, given time and space, the elements will begin to self-organize and display emergent behaviors.

The concept of complex adaptive systems is based on a theoretical framework founded in the study of the natural sciences, such as biology and chemistry.[45] Such systems are adaptive, changing to stimuli in the environment, to which they are inextricably connected.[46] This makes the framework of complex adaptive systems ideal for studying crowds, made up of numerous parts (individuals) that can appear to be nonlinear (unstructured and unpredictable) in their interactions, yet congeal into cohesive social behavior. Research by Li Zhao et al. is an example. Zhao and colleagues recognized the value of applying the concept of complex adaptive systems to explain competition for resources and resultant herd behavior among humans.[47]

There are, however, those who refute the efficacy of using complex adaptive systems, or the wider field of complexity theory, to explain group behavior. Some believe that social interactions are best explained by laws regarding individual behavior, and that individual patterns of behavior are incorrectly referenced as social systems.[48] Others, such as John Horgan, dispute the validity of complexity theory altogether. He asserts that, because of the many facets of complexity theory, "complexity exists, in some murky

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[43] Serena Chan, "Complex Adaptive Systems," Massachusetts Institute of Technology, last modified November 6, 2001, 1, http://web.mit.edu/esd.83/www/notebook/Complex%20Adaptive%20Systems.pdf.

[44] Roy J. Eidelson, "Complex Adaptive Systems in the Behavioral and Social Sciences.," *Review of General Psychology* 1, no. 1 (March 1997): 43, doi:10.1037/1089-2680.1.1.42.

[45] Chan, "Complex Adaptive Systems," 2; Dave Snowden, "Everything Is Fragmented—Complex Adaptive Systems at Play," *KMWorld Magazine* 17, no. 10 (November 1, 2008): 5, http://www.kmworld.com/Articles/News/News-Analysis/Everything-is-fragmented-Complex-adaptive-systems-at-play-51363.aspx.

[46] Chan, "Complex Adaptive Systems," 2.

[47] Li Zhao et al., "Herd Behavior in a Complex Adaptive System," *Proceedings of the National Academy of Sciences* 108, no. 37 (September 13, 2011): abstract, doi: 10.1073/pnas.1105239108.

[48] Eidelson, "Complex Adaptive Systems," 43.

sense, in the eye of a beholder," and that complexity theorists have not told us anything unique about the world around us.[49] He further believes the diverse approaches and definitions in the field have generated debate whether complexity theory is meaningless and therefore should be abandoned.[50]

Others believe complex adaptive systems are doomed to failure. David Woods and Matthieu Branlat, writing in *Resilience Engineering in Practice: A Guidebook*, have identified three fundamental pathologies leading to failure of such systems. They cite "decompensation, working at cross-purposes," and "getting stuck in outdated behaviors" as contributing factors to the failure of these systems.[51] They explain decompensation as a system's inability to adapt due to increasing environmental challenges. That is to say, challenges cascade more quickly than the system can devise responses.[52] When adaptations are adaptive on a micro scale but mal-adaptive from a macro view, Woods and Branlat contend the system works at cross-purposes, insuring its non-viability. This is apparent when groups strive to meet locally attainable goals in their own areas of influence, yet those goals are not coordinated among groups, leading to pathologies affecting the entire system.[53] Getting stuck in outdated behaviors is used to explain the over-reliance on past successes. Here, a system fails to learn from new environmental inputs, choosing instead to rely on what worked in the past, even if such methods may no longer be effective.[54] In light of such pathologies, this thesis asserts viewing crowds as complex adaptive systems is of value in understanding behavior of unruly crowds

In this qualitative exploration into the study of how complex adaptive systems apply to crowds, metaphors are used to draw comparisons of human adaptive behavior with that of other biological systems. Rich with such material, Dr. Rafe Sagarin's book

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[49] John Horgan, *The End of Science: Facing the Limits of Knowledge in the Twilight of the Scientific Age* (Reading, MA: Addison-Wesley, 1996), 197, 226.

[50] Horgan, *End of Science*, 197.

[51] David D. Woods and Matthieu Branlat, "Basic Patterns in How Adaptive Systems Fail," in *Resilience Engineering in Practice*, ed. Erik Hollnagel et al. (Burlington, VT: Ashgate, 2011), 127.

[52] Woods and Branlat, "Basic Patterns," 130.

[53] Ibid., 133.

[54] Ibid., 134.

Learning from the Octopus, studies adaptability of various biological systems, with emphasis on sea life. He provides juxtaposition between the human endeavor to combat terrorism through adaptive behaviors with complex systems of sea life adapting to survive.

Sagarin is not alone in his comparisons of humankind with other biological systems. Dr. Donald Laming of the University of Cambridge recognizes that each biological species requires a catalog of instinctive, hardwired, behavioral patterns; humans are no exception.[55] There are similarities between adaptive behaviors of animals and those of crowds confronted by police. For instance, both harness the power of learning from changes in the environment as a first step in adaptability, a step confirmed by Sagarin and Laming in their works.[56]

C. POLICE RESPONSE TO CROWD ACTIONS

Police methods of crowd control are the subject of research in this section. As newer "soft," non-confrontational methods evolve in handling crowds, it is important to understand the underpinnings from which these newer methods have evolved.

Research by Drury and Riecher involving *elaborated social identity modeling* has shown how methods of public order policing can often determine whether conflict emerges between police and crowds.[57] They provide an example of how English soccer fans united in violence against Italian police after what the English fans believed to be indiscriminate use of force against them by law enforcement.[58] Heavy-handed, or confrontational "hard" tactics have been the staple of police response to perceived unruly crowds in the past. One only need look at urban riots of the '60s, or the 1968 Democratic Convention, where club-wielding police clashed with demonstrators in a bloody melee on

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[55] Laming, *Understanding Human Motivation*, 2.

[56] Rafe Sagarin, *Learning from the Octopus: How Secrets from Nature Can Help Us Fight Terrorist Attacks, Natural Disasters, and Disease* (Jackson, TN: Basic Books, 2012), 35; Laming, *Understanding Human Motivation*.

[57] C. Stott, J. Hoggett, and G. Pearson, "'Keeping the Peace': Social Identity, Procedural Justice and the Policing of Football Crowds," *British Journal of Criminology* 52, no. 2 (March 1, 2012): 381, doi: 10.1093/bjc/azr076.

[58] Scott, Hoggett, and Pearson, "Keeping the Peace."

the streets of Chicago.[59] The indiscriminate use of such force was, and still is, rightly called into question.

Indeed, even today, the heavy-handed "hard" approach was evident in Ferguson, Missouri, where police utilized military-style tactics and equipment to confront demonstrators.[60] This approach was taken in light of gunfire directed at law enforcement, as documented in a federal investigation into the event, and as seen on video from local television.[61] This approach was recently repeated in Columbus, Ohio, where the *Columbus Dispatch* newspaper featured a story and video of police SWAT dowsing non-violent sports fans with pepper spray.[62] There is no shortage of news stories highlighting these and similar events.

Looking at official government documents, there is ample material reinforcing the "hard" approach to public-order policing. One example is a training manual from the Department of Homeland Security which highlights the many methods police can use to control crowds. Such methods involve use of riot control agents like tear gas and "less than lethal" munitions, hard-shell protective clothing and military style team tactics.[63] These methods are also mentioned in other documents, such as those from the Police Executive Research Forum discussing "less lethal devices" and military style tactics.[64]

Further research by Patrick Cronin and Stephen Reicher focuses on the decision-making process of police commanders in crowd control situations. Specifically, it studies how accountability factors into their decisions, and how such decisions factor into police

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[59] "1968 DNC: Democratic Nightmare in Chicago," YouTube video of Hubert Humphrey's nomination in 1968, posted by "Passionate Patriots," September 29, 2008, https://www.youtube.com/watch?v=epxmX_58tOo.

[60] Sandy Banks, "Accountability on All Sides; The Looters and Cops in Ferguson Should Be Held Responsible," *Los Angeles Times*, August 19, 2014, sec. Main News, Part A, Metro Desk.

[61] U.S. Department of Justice, *After-Action Assessment of the Police Response to the August 2014 Demonstrations in Ferguson, Missouri* (Tallahassee, FL: Institute for Intergovernmental Research, 2015), 8, https://www.hsdl.org/?abstract&did=786908&fromemail=1; "Shocking Video of Tactical Unit Getting Fired upon, Top Cops Explains," YouTube video from The McGraw Show, posted by "KTRS550TV," August 22, 2104, 1:38, https://www.youtube.com/watch?time_continue=128&v=g73bb0M2IcE.

[62] Jarman and Woods, "Tear Gas Disperses."

[63] Center for Domestic Preparedness, "Managing Civil Actions."

[64] Tony Narr et al., *Police Management of Mass Demonstrations: Identifying Issues and Successful Approaches* (Washington, DC: Police Executive Research Forum, 2006), 59.

response to unruly crowd behavior.[65] By subjecting several supervisory-level officers from the London Metropolitan Police to a table-top exercise involving a crowd control scenario, researchers concluded accountability concerns are a major factor in the decision-making process.[66] Such concerns are important considerations for incident commanders when determining what methods to employ in controlling an unruly crowd.

D. STRATEGIC ISSUES FOR POLICE

Research from the Police Executive Research Forum has identified a number of strategic police issues regarding crowd control. Among them are: the need for cooperation among law enforcement, how to balance first amendment rights and other civil liberties with public safety concerns, and how to educate the public about police proportionate responses.[67] Other concerns revolve around proper planning for such events. The aforementioned manual from the Department of Homeland Security highlights the importance of planning, command and control, departmental philosophy, and more.[68] Many of these themes are also addressed by Masterson in *Crowd Management: Adopting a New Paradigm.* These are all issues of policy that must be addressed by law enforcement agencies if they are to be prepared for crowd control operations.

Another strategic issue for police is whether they are employing best practices and sharing lessons learned regarding crowd control tactics, training, and philosophy.[69] According to Masterson, collaborative efforts between law enforcement in the United States, Canada, and England have yielded newer ways to deal with the strategic issues surrounding crowd control.[70]

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[65] Patrick Cronin and Stephen Reicher, "A Study of the Factors that Influence How Senior Officers Police Crowd Events: On SIDE Outside the Laboratory," *British Journal of Social Psychology* 45, no. 1 (March 2006): 176, doi: 10.1348/014466605X41364.

[66] Cronin and Reicher, "A Study of the Factors," 193.

[67] Narr et al., *Police Management*, 4–5.

[68] Center for Domestic Preparedness, "Managing Civil Actions," PTI-1, 14, 7.

[69] Mike Masterson, "Crowd Management Adopting a New Paradigm," *FBI Law Enforcement Bulletin* 81, no. 8 (August 2012): 1.

[70] Masterson, "Crowd Management," 2.

Perhaps the most important strategic issue to consider is adopting new paradigms of thinking to policing crowds. This work provides a foundation for new thinking on crowds and their behavior. Research conducted by Stephen Reicher has identified, through elaborated social identity monitoring, that police departments can best handle crowds when they engage them in a non-confrontational manner. From that research, Masterson cited that two emergent, non-confrontational, or "soft," methods have evolved—the Cardiff Approach and the Madison Method.[71] Both methods are considered in this research, and are juxtaposed with the traditional "hard" approaches to examine the efficacy of these different methods.

E. CROWD ADAPTATION

Recent years have seen a number of crowd control events which have spiraled out of control into violent confrontations between police and crowds. As a result, many protest-oriented crowds have adopted organized tactics and equipment to thwart efforts at policing by law enforcement. This literature review has only identified one scholarly study that explicitly examines this metamorphosis. All other evidence was anecdotal. Lesley J. Wood, professor of sociology at York University in Toronto, Canada, has researched the diffusion of protest movements and methods in *Direct Action, Deliberation, and Diffusion: Collective Action after the WTO*. Her research examines emergent relationships among affinity groups of activists, and their evolution of tactics through organization and training. For example, she studies the concept of diversity-of-tactics among protesters as a way to adapt to changing police tactics.[72]

Though much of the literature regarding adaptation of protester tactics is less than rigorous in its academic approach, it may still be usable if corroborated through further research and first-hand observations. Such Internet publications as "Bodyhammer: Tactics and Self-Defense for the Modern Protesters" and "Warrior Crowd Control and

[71] Ibid., 3.

[72] Lesley J. Wood, *Direct Action, Deliberation, and Diffusion: Collective Action after the WTO Protests in Seattle* (New York: Cambridge University Press, 2012), 108.

Riot Manual," both aesthetically crude publications detailing anti-police tactics for protesters, are examples of such literature.[73]

F. CONCLUSION

The body of work studying crowd interactions with police is voluminous. Much of it is scholarly and well researched. Some works, such as amateur video and anecdotal accounts, do not meet scholarly standards. That does not preclude them from consideration in this study if such works can be validated by real-life encounters and rigorous corroboration.

There are endless accounts of encounters between unruly crowds and the police across the United States and the globe. Numerous studies abound on the psycho-social aspects of crowds and how they react to the presence of police. Lacking in volume are scholarly studies on how crowds have adapted to police efforts at crowd control. This presents an opportunity for further research. Also plenty are works addressing the concept of complex adaptive systems as they apply to crowds. Examples are provided by authors like Eidelson and Zhao et al. In their works, crowds are viewed holistically to obtain an overall perspective on collective behavior. Their works, however, do not directly address the issue of unruly crowds as complex adaptive systems in crowd control situations involving law enforcement. This study's methodology of viewing crowds from a systems perspective will provide new insights into crowd behavior and provide law enforcement with new ways to look at the problem of controlling unruliness through policy, training, and equipment.

Direct, scholarly comparisons of police tactics involving both "hard" and "soft" paradigms of policing crowds are lacking. What exists are anecdotal accounts of one tactic versus the other. That scarcity of scholarly comparisons presents a gap this study may fill. Opportunity also exists for further research in how police respond to crowds, given the dynamics of the situation. The Cardiff and Madison methods of policing provide a chance to examine whether the "hard" or "soft" approach is more useful.

[73] See Sarin, "Bodyhammer: Tactics and Self-Defense for the Modern Protester," accessed December 13, 2015, http://it.stlawu.edu/~quack/shieldbook.pdf; "Warrior Crowd Control & Riot Manual," Warrior Publications, accessed February 27, 2016, https://archive.org/details/WarriorCrowdControlRiotManual.

Adaptations by crowds directed at the police have yet to be rigorously examined. This study presents researchers an opportunity to uncover unique insights on crowd adaptation, thus addressing a gap in knowledge with strategic implications on policing of unruly crowds.

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III. COMPLEX ADAPTIVE SYSTEMS

> Rules are at the heart of the agent (element) and the agent is the heart of the system.
>
> —Dr. Michael Agar, emeritus professor[74]

Studying systems is crucially significant, especially when describing crowds. Studying systems allows for a view of crowds that "transcends traditional disciplinary boundaries," such as those found in psycho-social explanations of crowd behavior.[75] Understanding crowds as complex adaptive systems is to understand them as dynamic systems, comprised of multiple, nonlinearly interacting elements that self-organize to a critical mass, where even a slight perturbation begets tumultuous change.[76] Viewing systems in this manner eschews traditional, static, linear models of explanation, and focuses instead on "nonlinear dynamic systems, difficult to predict, with emergent properties not reducible to their elements."[77] This thesis applies a systems view, providing new perspectives on disruptive crowds.

A. WHAT IS A COMPLEX ADAPTIVE SYSTEM?

To understand a complex adaptive system, we must first define what it is, and what it is not. At its base, it is a system. A system is a construct that enables us to understand the world around us, and is comprised of "a group of parts called elements, that function together to form a whole."[78] Alternatively, a system can be explained as an assimilation of parts or processes that work together to produce something emergent from

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[74] Michael Agar, "Complexity Theory: An Exploration and Overview Based on John Holland's Work," *Field Methods* 11, no. 2 (November 1, 1999): 106, doi: 10.1177/1525822X9901100201.

[75] "Why Study Systems?," Systems Theory and Modeling, accessed September 8, 2015, http://sep.csumb.edu/esse21/concepts.html.

[76] Dynamic systems are those that are prone to change. Nonlinearly interacting elements refers to the disorder in communications among the elements of the system.

[77] "Why Study Systems?," Systems Theory and Modeling.

[78] "Complexity Science: 2 Complexity Theory," YouTube video, posted by "Complexity Academy," April 18, 2014, 00:19, https://www.youtube.com/watch?v=P00A9IZ7Pog&feature=youtube_gdata_player.

the interaction of the system's parts.[79] A system may be *open*, where it takes inputs from the environment and adapts accordingly, or it may be *closed*, where no external inputs are present, and the system focuses on internal events.[80]

Systems are all around us. A home computer system is one example. It contains elements such as a central processor where computational machinations are performed, a keyboard for inputting data, a printer for hard copies of results, a screen for observing results, and cables to connect the elements, allowing them to interact with one another. Separately, these elements do not constitute a system. By combining them, and adding the final element of human interaction, they create a closed system. The elements only interact with one another toward some purpose in this closed system. In contrast, the same system is open if it is subject to outside influences from the Internet, where third-party algorithms influence results of queries.

According to Dave Snowden, chief researcher at Cognitive Edge, an international research network based in England, three types of systems exist: ordered systems, chaotic systems, and complex adaptive systems.[81] Ordered systems possess repeating relationships between elements, or as Snowden calls them, agents, which give way to predictable cause-and-effect relationships.[82] In ordered systems, the elements' behaviors are constrained by the system.[83] The aforementioned computer system is ordered, and therefore constrained and predictable, driven by the cause-and-effect relationship between the user and the rest of the system.

The theory of the Incident Command System (ICS), used to organize a response to an emergency event, is a component of the larger National Incident Management

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[79] Joshua Cooper Ramo, *The Age of the Unthinkable : Why the New World Disorder Constantly Surprises Us and What We Can Do about it*, 1st ed. (New York: Little, Brown, 2009), sec. "Key Concepts Explained."

[80] Jennifer M. Allen and Rajeev Sawhney, *Administration and Management in Criminal Justice: A Service Quality Approach* (Thousand Oaks, CA: SAGE, 2009), 27–28.

[81] Snowden, "Everything Is Fragmented," 1, 5.

[82] Ibid., 1.

[83] David J. Snowden and Mary E. Boone, "A Leader's Framework for Decision Making," *Harvard Business Review* 85, no. 11 (2007): 3.

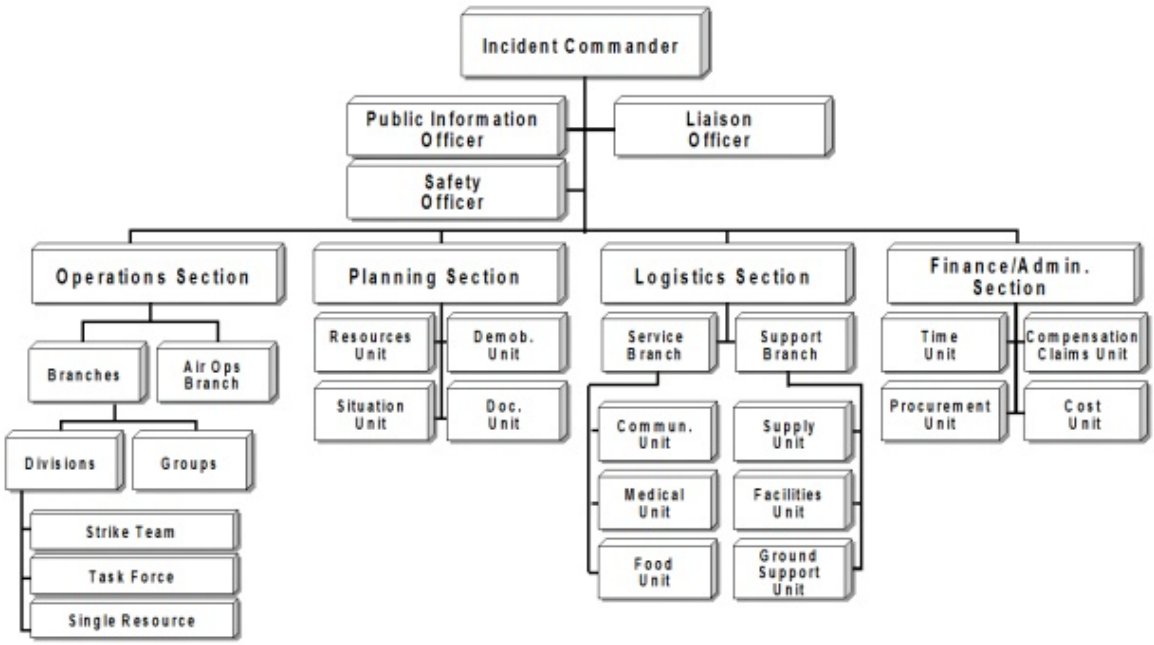
System, and another example of an ordered system.[84] ICS is composed of a command staff element and a general staff element. The command staff answers to the incident commander and is comprised of public information, safety and liaison elements.[85] The general staff, which has functional responsibilities to the system, has six major elements called sections: command, operations, planning, logistics, and finance.[86] Each section is run by a section chief, who is answerable to the incident commander. Each section is parent to branches, division/groups, and resources as deemed necessary by the incident's complexity. All elements in ICS have their own responsibilities in this ordered, open system, which takes inputs from the external environment. They interact with the others in a linear fashion from the top down, in a defined chain of command, where subordinates answer to only one supervisor to achieve results. This makes interactions between elements in ICS orderly and predictable, as depicted in Figure 1. The cause-and-effect relationship between the incident commander and other elements in ICS is evident where the commander issues directives that result in action by subordinate elements.

[84] U.S. Department of Homeland Security, *National Incident Management System (NIMS)* (Washington, DC: U.S. Department of Homeland Security, December 2008), 45.

[85] U.S. Department of Homeland Security, *NIMS*, 51.

[86] Ibid., 53.

Figure 1. Incident Command System



Source: "ICS Organizational Chart," FEMA, January 11, 2015, https://training.fema.gov/emiweb/is/icsresource/assets/icsorganization.pdf.

Snowden describes a chaotic system as one in which the agents are unhindered by any rules of behavior and are often present in large numbers.[87] Systems comprised of fewer elements can exhibit chaotic qualities as well. Heterogeneity of the components produces sensitivity to initial conditions, giving way to large-scale effects with even minor perturbations.[88] The field of meteorology is an example of such a system. Groundbreaking research on weather by MIT scientist Edward Lorenz led him to conclude the atmosphere is, indeed, chaotic.[89] The number of elements to be considered in predicting the weather is extensive. They include: temperature, humidity, barometric pressure, clouds, sunshine, winds, topography, and oceanic influences. These elements interact with each other and are sensitive to the initial state of each. This is akin to

[87] Snowden, "Everything Is Fragmented," 5.

[88] Karen June Tesson, "Chaos Theory, Complexity Theory and Emergence," Inclusional Research Forum and Learning Space, accessed August 22, 2015, http://www.inclusional-research.org/comparisons4.php; Stephen Wolfram, *A New Kind of Science* (Champaign, IL: Wolfram Media, 2002), 13.

[89] Edward Lorenz, *The Essence of Chaos* (Seattle: University of Washington Press, 1993), 102.

multiple, independent agencies responding to a wide-ranging disaster without employing ICS. The response would be a chaotic system due to the lack of coordination. Compounding the chaotic system would be multiple variables, such as training, communications, and organizational differences, affecting response.

An open system that is both complex and adaptive is similar to the chaotic systems just described in that they comprise elements that interact with each other and change with stimuli. That, however, is where the similarities end. Systems are complex when their "internal dynamics confound easy description and often defy prediction."[90] ICS theory, with its linear reporting lines, is quite the opposite, despite this author having witnessed that, in practice, this theory does not always follow linearity. The interactions among the elements in complex adaptive systems are nonlinear. That is to say, the interactions among elements do not flow in an orderly, logical manner, as in ICS.

The interactions depicted in Figure 2 are characterized by *nonlinearity*, an integral property of complex adaptive systems.[91] According to Michael Agar, "Nonlinearity is about multiple, densely connected, overlapping feedback loops that link, and let go, and link again."[92] He also posits, "Nonlinearity ensures that their trajectory will move in unexpected ways, given the webs of connections among the agents."[93] This nonlinearity among elements, which is responsible for unpredictability, is of particular interest to social researchers, and is an area of focus in this thesis.[94]

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[90] Ramo, *Age of the Unthinkable*, 16.

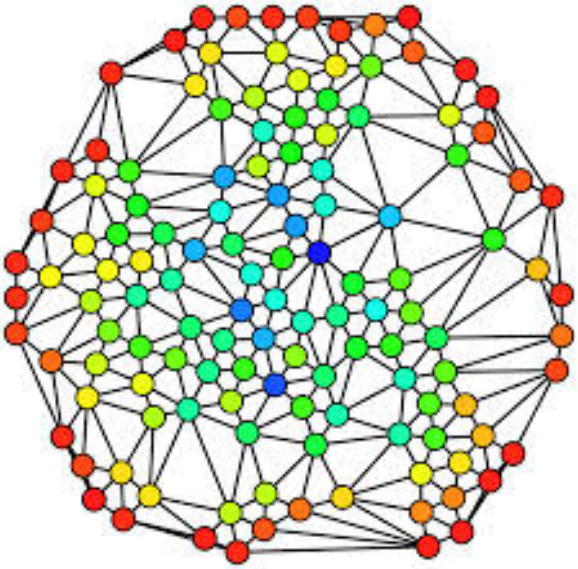
[91] Agar, "Complexity Theory," 100.

[92] Ibid.

[93] Ibid., 111.

[94] Ibid., 100.

Figure 2. Nonlinear Interaction



Source: *Wikipedia*, s.v. "Social Network Analysis," accessed December 26, 2015, https://en.wikipedia.org/w/index.php?title=Social_network_analysis&oldid=696898318.

Adherence to simple rules is another important feature of complex adaptive systems. Simple rules influence the interactions between elements of the system.[95] Agar suggests some elements follow the simple *condition-action rule*, where under certain conditions elements of the system perform a particular action.[96] For example, the condition of winter's onset results in the action of birds flying south to warmer climes. However, some rules can be more complex. Snowden and Boone argue such rules result in complex phenomena.[97] Flocking of birds is an example. By following the simple rules of, "fly to the center of the flock, match speed, and avoid collision," birds can flock without flying into one another in a display of emergent, self-organizational behavior.

[95] Tesson, "Chaos Theory."

[96] Agar, "Complexity Theory," 106.

[97] Snowden and Boone, "A Leader's Framework," 3.

B. SELF-ORGANIZED CRITICALITY

Roy Eidelson describes a complex adaptive system as "a large collection of diverse parts interconnected in a hierarchical manner such that organization persists or grows over time without centralized control."[98] What Eidelson describes, essentially the creating of organization, at first glance seems unlikely in such systems due to their chaotic nature. However, researchers have recognized a process, termed *self-organization*, which often occurs despite the irrational, nonlinearity of relationships among the elements: "Complex systems self-organize, absent any central authority."[99] Karen Tesson supports the idea that such systems, despite their chaotic character, have the capacity to create non-chaotic, predictable patterns of behavior.[100] Further, at Complex Systems Innovation, a British company specializing in complexity engineering issues, complexity has been found to create behaviors not purposely designed into the system.[101] One such behavior is elements' ability to create a bottom-up organizational structure, as the individual elements interact and synchronize with one another.[102] It is this interaction among the elements following unwritten rules that creates self-organization. The previous example of a flock of birds provides and exemplar of self-organization.

Self-organization takes place at different levels, both micro and macro, in complex adaptive systems. The micro-level occurs at the level of the individual elements, where their nonlinear interactions congeal to produce spontaneous patterns of behavior owing to the presence of rules governing behavior. These micro-level organizational constructs can join to form macro-level structures with hierarchical characteristics. An example of this dynamic is provided by Complexity Learning Lab in the formation of human culture. They contend standardized interactions emerge from a heterogeneous collection of people via personal or electronic interaction (social media). Over time, these

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[98] Eidelson, "Complex Adaptive Systems," 43.

[99] Agar, "Complexity Theory," 108.

[100] Tesson, "Chaos Theory."

[101] "Complex Organisation," csi, accessed January 10, 2016, http://www.csysi.co.uk/?page_id=32.

[102] "Complexity Science: 2," 1:49.

interactions may take the form of norms, such as greetings, language, or rituals, which regulate behavior without centralized control.[103] These norms eventually result in a larger body of interaction and homogeneity, thus forming a macro level of organization.[104] One can contrast this to the ICS, in which pre-set rules provide a deterministic system whereby linear interactions among elements are predictable.

The environment in which self-organization occurs has a profound effect on organizational stability. Lorenz recognized sensitivity to initial conditions in the environment factored significantly in system behavior.[105] Building off of Lorenz's work, James Gleick recognized complex adaptive systems are sensitive to initial environmental conditions, where "small perturbations in one's daily trajectory can have large consequences."[106] This occurs as systems self-organize. They do so to a point of instability, where those environmental perturbations can lead to dramatic consequences to the system. This phenomenon, the tipping point between stability and change, is referred to by scientists and researchers as *self-organized criticality*. Eidelson recognized self-organized criticality as the governing principle behind self-organization.[107] A famous example of self-organized criticality is the sand pile experiments performed by Per Bak. Bak tested the idea by methodically building small piles of sand, grain by grain, in his laboratory. Before the piles grew, they were relatively flat, in a state of stasis or equilibrium. Bak called this the "transient stage."[108] As the slopes of the piles increased, he observed individual grains of sand caused small, localized disturbances he called "avalanches."[109] Large avalanches were absent, as the piles held together via the interaction of the individual grains of sand. As the slopes continued to grow, and the sand

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[103] "Complexity Science: 7 Complex Adaptive Systems," YouTube video, posted by "Complexity Academy," May 14, 2014, 3:15, https://www.youtube.com/watch?v=rl0yFwcGx_o; Eidelson, "Complex Adaptive Systems," 44.

[104] "Complexity Science: 7," 3:15.

[105] Lorenz, *The Essence of Chaos*, 8.

[106] James Gleick, *Chaos : Making a New Science* (New York: Viking, 1987), 67.

[107] Eidelson, "Complex Adaptive Systems," 54.

[108] Per Bak, *How Nature Works: The Science of Self-Organized Criticality* (New York: Copernicus, 1996), 59.

[109] Bak, *How Nature Works*, 50.

piled higher, pressure was exerted on the interacting grains to the point where another grain would cause large avalanches. This was the point of self-organized criticality, the stage where the piles became a "functional unit," reacting *en masse* to an environmental stimulus, such as another grain of sand.[110]

Applying the concept of self-organized criticality to social groups is more difficult than applying it to inanimate piles of sand subject to the laws of gravity, and influenced by friction and angularity. Since interactions among thinking beings create more complicated circumstances, deterministic causal laws do not apply.[111] This adds another level of complexity to systems already marked by chaotic, nonlinear interactions leading to unpredictable behaviors. This thesis explains how these behaviors emerge from such circumstances by viewing the entire aggregation of elements in a holistic manner, as a system.

C. EMERGENCE

Nothing in the makeup of the elements in complex adaptive systems lends itself to assuming or predicting behavior. Yet, through interaction of the elements following simple rules, these systems do unpredictable things. This is known as *emergence*, a key concept in this thesis.[112] David Snowden and Mary Boone summed up emergence when they asserted the whole is greater than the sum of its parts in dynamic systems. They went on to say characteristics of the system "arise from the circumstances."[113] Those circumstances take on myriad forms. One example is when circumstances take the form of environmental factors, such as stimuli lying outside the system that effect elemental interactions. Circumstances are also found within the system itself. Factors, such as the

[110] Ibid., 60.

[111] Eidelson, "Complex Adaptive Systems," 63.

[112] Agar, "Complexity Theory," 106.

[113] Snowden and Boone, "A Leader's Framework," 3.

proximity of elements to each other, or the strength of ties between elements, also affect emergent characteristics.[114]

By studying emergence, it is possible to explore how macro-level order results from interaction of heterogeneous elements in a system without central control.[115] For example, consider where a pedestrian becomes trapped under an automobile during a crash and several strangers stop to help. No controlling authority is present and confusion reigns as these strangers gather. But as they continue to interact, self-organization occurs, and a purpose—to lift the vehicle off the victim—emerges. From there, a controller emerges and coordinates the process of lifting the car off the victim. It is possible to say emergence is a bottom-up process given this example.[116] This process has been modeled by researchers, such as Stephen Wolfram, by using cellular automata, where a compilation of colored cells on a grid emerge during iterative steps following simple rules based on the state of neighboring grid spaces.[117]

In Wolfram's cellular automata modeling (see Figure 3), a two-dimensional grid starts with a single gridline containing a single colored square. Subsequent time step iterations add new lines to the grid one at a time, following a simple rule: a grid square must take on the characteristics of its neighbor. The grid becomes populated by colored squares according to the set rules. Over time, subsequent iterations reveal an emergent pattern of colored squares. Nothing in the nature of the colored squares themselves reveals any tendency to produce a pattern. However, subjecting the squares to a simple set of rules over time produces characteristics that were unpredictable at the outset.

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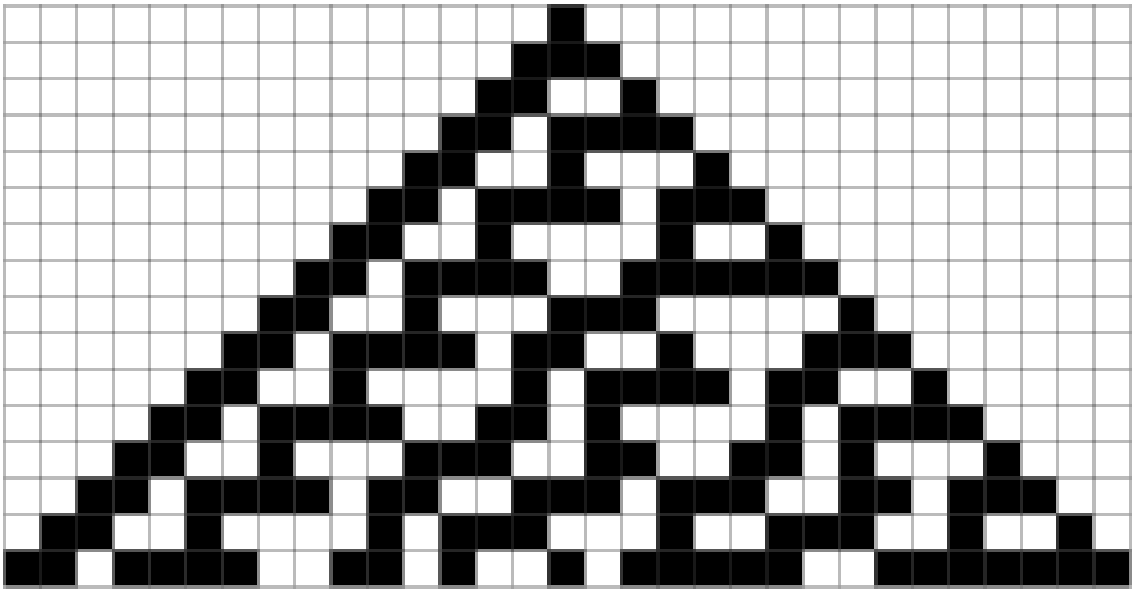
[114] Marketing researchers have discovered information dissemination is dependent upon the strength of ties between elements. Jacob Goldenberg, Barak Libai, and Eitan Muller, "Talk of the Network: A Complex Systems Look at the Underlying Process of Word-of-Mouth," *Marketing Letters* 12, no. 3 (August 2001): 217.

[115] "Complexity Science: An Overview," *Vimeo*, 2013, 2:25, https://vimeo.com/55132439.

[116] "Complexity Science: An Overview," 1:49.

[117] "Cellular Automaton," Wolfram MathWorld, accessed September 5, 2015, http://mathworld.wolfram.com/CellularAutomaton.html.

Figure 3. Cellular Automata Example



Source: "Cellular Automaton," Wolfram MathWorld, accessed September 5, 2015, http://mathworld.wolfram.com/CellularAutomaton.html.

Though cellular automata modeling may be an oversimplification describing the phenomenon of emergence in complex, real-world systems, it does present, in the most basic terms, an elemental exemplar of emergence.

D. LEARNING AND ADAPTING

Critical to the success of biologically based complex adaptive systems is the capacity to sense the environment, and thus modify goal-oriented behavior.[118] This key feature of such systems is known as *metis*.[119] Metis enables systems to learn from interactions with the environment and adapt their behavior accordingly. Indeed, "learning is at the heart of adaptation."[120] Understanding the impact of environmental conditions on metis, and metis' effect on complex adaptive systems, is critical to understanding how

[118] Eidelson, "Complex Adaptive Systems," 57.

[119] Sagarin, *Learning from the Octopus*, 43. *Metis* is gained through interaction and experience with the environment. The opposite is *Techne.* This is gained from learning through academic training and other formal learning methods.

[120] Ibid., 39.

such systems adapt. Agar recognized this fact when he asserted, “Environment is the ultimate yardstick for the system’s success.”[121]

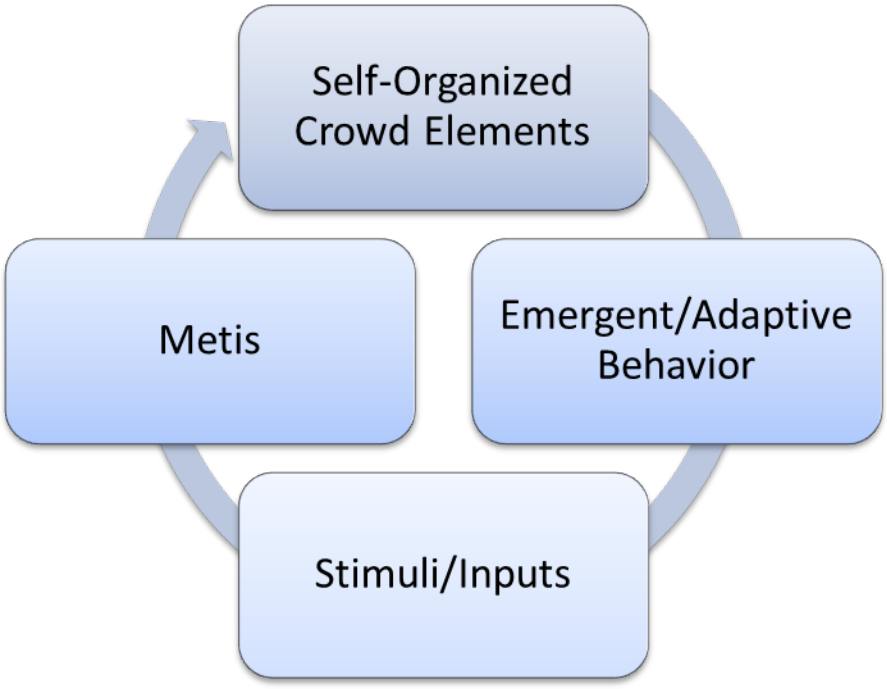
How complex adaptive systems learn to adapt is of critical importance in the understanding of such systems, because adaptation is made possible by learning.[122] Feedback loops carrying messages back and forth between elements within the system are important to metis. In complex adaptive systems, feedback loops are not linear. Information does not flow through successive elements and back to the original element in an orderly fashion. The information contained in the feedback loops can pass through several elements, all interacting with each other, before returning to the originating element in modified form (as seen previously in Figure 1). Agar recognized the importance of feedback loops when he posited, “Outputs of some agents are inputs for others, so that what starts out as a collection of individual agents turns into a coordinated crowd.”[123] This occurs as feedback loops modify system behavior by delivering constantly changing information about the environment from element to element and back again, enabling metis. Metis, combined with additional inputs from the environment, follows a feedback loop back to self-organized crowd elements, which adapt behavior accordingly. This process, as shown in Figure 4, continues until interrupted.

[121] Agar, “Complexity Theory,” 111.

[122] Sagarin, *Learning from the Octopus*, 35.

[123] Agar, “Complexity Theory,” 109.

Figure 4. Simplified Feedback Loop



There are two kinds of feedback, *positive* and *negative*, in systems theory. Positive feedback describes the loop's tendency to amplify changes on the system. It is not necessarily indicative of something good or increasing.[124] An example of a simple, positive feedback loop is illustrated in the interaction between two drivers involved in a road-rage incident. If Driver #1 cuts in front of Driver #2, Driver #2 takes exception to the move and begins to tailgate Driver #1. Driver #1 then escalates the situation in response by braking hard, nearly causing a collision with Driver #2, who now pulls alongside Driver #1 and motions for him to stop. Both drivers stop and a fist-fight ensues in the middle of the road. Each action of the drivers was met with a response, thus completing the feedback loop, which continued to repeat itself and escalate the continuum until the fisticuffs. Since one action precipitated another, and so on, this can be considered a positive feedback loop. A negative feedback loop, on the other hand, works to counteract any change in the system.[125] Using the same road-rage example, the

[124] "Systems Theory and Modeling," sec. Key Concepts Explained.

[125] Ibid.

presence of a police car in the area would likely counteract the initial actions by Driver #1 and prevent any change in the system.

An example of a positive feedback loop is provided by Eidelson. He stated, "If business enterprises benefit from being in close proximity to other firms, then a self-reinforcing process will lead to industrial concentration in particular areas. These areas need not even have any inherent merit over geographic regions that ultimately fail to thrive."[126] Positive feedback is quite often a determining factor in the trajectory of self-organization in a complex adaptive system.[127]

As stated previously, positive feedback is not necessarily a good thing. It needs only to amplify changes to a system, as in our road-rage example. A concept known as the *competency trap* illustrates this point.[128] In a competency trap, the user seeks less-than-optimal solutions in order to learn a particular way of doing things. There is little incentive to seek alternate, perhaps more beneficial, ways of doing things when the same old way continues to reinforce success, as suboptimal as it may be.[129] An example would be a police department that handles crowd control situations in the same manner each time because of past successes. While good enough to get by, the department is missing opportunities to develop alternate ways of handling such events which could prove more beneficial to the department and the community.

The competency trap need not be a fatal flaw. In biology, it actually ensures perpetuity of systems. Wolfram pointed out that biological organisms often contain features that, while not optimal, are "good enough to survive."[130] Biological systems that constantly run at optimum capacity burn out and break down in short order.

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[126] Eidelson, "Complex Adaptive Systems," 49–50.

[127] Ibid., 49.

[128] Ibid.

[129] Ibid.

[130] Wolfram, *A New Kind of Science*, 386.

E. ATTRACTORS

Attractors are another important concept related to complex adaptive systems. According to Ralph Stacey of the University of Hertfordshire, attractors are "global patterns of behavior displayed by a system."[131] An attractor will present what J. Barkley Rosser, Jr. calls "a basin of attraction" to which the system will approach.[132] These are behaviors around which system elements will coalesce to form generalized behavior. Examples of how attractors affect the behavior of complex adaptive systems are presented in case studies in this work.

F. REFUTING COMPLEX ADAPTIVE SYSTEMS

Is the concept of complex adaptive systems applicable to the social sciences? Can it help explain the behavior of humans, especially those who gather *en masse*? Previous references to sand piles, computer systems, and simulations may cast doubt about this perspective's human relevance. However, Gell-Mann, Eidelson, and others have seen the efficacy of using complex adaptive systems to explain human behavior.[133] Despite its basis in the natural and physical sciences, Gell-Man sees the potential for broader application to social science.[134] Agar writes, "I think that the case has been made that complexity is a useful new formalism worthy of consideration by social researchers."[135]

Human society possesses many characteristics of complex adaptive systems. There are a large number of diverse elements (people, processes, social constructs) making up the system we call society. These elements often interact in a chaotic, nonlinear manner while sensing the environment. In time, following simple rules, the elements create unpredictable complex behaviors. One can look to the world of

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[131] Ralph D. Stacey, *Complexity and Group Processes: A Radically Social Understanding of Individuals* (New York: Brunner-Routledge, 2003), 44.

[132] J. Barkley Rosser, Jr., "On the Complexities of Complex Economic Systems," *Journal of Economic Perspectives* 13, no. 4 (November 1, 1999): sec. Complexity and Controversy: Conclusions.

[133] Eidelson, "Complex Adaptive Systems," 34.

[134] Ibid., 42.

[135] Agar, "Complexity Theory," 118.

economics to see an example. Given this information, applying the concept of complex adaptive systems to the study of crowds has worth. But not all agree.

Francis Heylighen and Donald Campbell suggest that individual patterns of behavior are best at describing social systems.[136] This would be more in line with psycho-social explanations of social phenomena. Such explanations represent a reductionist view, looking at individuals as opposed to viewing the aggregate as a system. This view fails to account for the interconnectedness of crowd elements, and how perturbations in one part of a crowd may produce systemic consequences in others. Others have argued the numerical modeling and computer simulations found in the study of complexity theory are not conducive to the study of biological forms. Naomi Oreskes of Dartmouth College argues, "Verification and validation of numerical models of natural systems is impossible."[137] Oreskes is arguing that biological systems are open, subject to environmental influences where computers and simulations could never account for all the variables and resultant outcomes. As a result, our knowledge of such systems is not entirely complete.[138] Stacey supports these arguments by asserting, "Complexity theory cannot be applied directly to human actions because human interaction is not deterministic."[139] Yet, complexity theory was never meant to explain deterministic behaviors. It does not lend itself to such explanations due to the chaotic nature of such systems. Complex adaptive systems, by nature, do not lend themselves to deterministic behavior due to nonlinearity of interactions among elements.

Heylighen, Campbell, Oreskes, and Stacey all argue absolutist summations of their positions against the use of complexity theory to explain human interactions. There are no absolutes when considering human behaviors due to the multitude of complex computations the brain goes through as it factors in variables. Just as complexity theory

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[136] Francis Heylighen and Donald Campbell, "Selection of Organization at the Social Level: Obstacles and Facilitators of Metasystem Transitions," *World Futures: The Journal of General Evolution* (1995): 2, http://pespmc1.vub.ac.be/papers/SocialMST.pdf.

[137] John Horgan, "From Complexity to Perplexity," *Scientific American* (June 1995), http://www2.econ.iastate.edu/tesfatsi/hogan.complexperplex.htm.

[138] Horgan, "From Complexity to Perplexity."

[139] Stacey, *Complexity and Group Processes*, 46.

helps explain that which is not deterministic, it also helps explain that which cannot be explained in absolutist terms.

Other detractors of complexity theory cite confusion in terminology, asserting the term *complexity* itself has many meanings among various scientific disciplines.[140] Seth Lloyd of MIT has discovered over forty-five definitions for the word, many focusing on computational or informational metrics.[141] This lends itself to confusion among researchers and scientists over the application of the term. It could be argued the definition of complexity is an emerging one, driven by disparate views of various elements in the sciences.

While the detractors of complexity theory are many, and their arguments valid, so too are its supporters and arguments. This polarization, although acute, is healthy in the field of science. Competing models engender polarization of ideas and encourage "pointed questions."[142] Without this dynamic, new ideas and new ways of viewing phenomena would stagnate, and the breadth and diversity of new theories to explain the world around us would grind to a halt.

Viewing crowds as complex adaptive systems during interactions with law enforcement is in keeping with the development of new ways to view things. While the reductionist paradigm of viewing crowds as an aggregation of individuals using psycho-social explanations has merit, viewing crowds from a systems perspective sheds new light on the subject, providing new explanations for crowd behavior.

G. CROWDS AS COMPLEX ADAPTIVE SYSTEMS

Viewing crowds as ordered, chaotic, or complex adaptive systems follows complexity theorists' position that looking at the whole of an organism is fundamental to biology and, thus to understanding behavior.[143] Initially qualifying crowds as complex

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[140] Eidelson, "Complex Adaptive Systems," 42.

[141] Rosser, "On the Complexities of Complex Economic Systems," 170.

[142] Mark Kac, "Some Mathmatical Models in Science," *Science* 166, no. 3906 (November 7, 1969): 699.

[143] Roger Lewin, *Complexity: Life at the Edge of Chaos* (New York: MacMillan, 1992), 35.

adaptive systems is paramount to employing this model of crowd behavior. One can identify if the crowd qualifies as a complex adaptive system by utilizing the characteristics indicative of such systems. To make that determination, one must ask the following qualifying questions:

1. Does the crowd contain multiple, independent elements, devoid of a central authority?

   Independent elements are not bound by rational thinking or rational rules of interaction governing concerted efforts. There is no central figure controlling system inputs or outputs.

2. Are the interactions between elements characterized by nonlinearity?

   Nonlinear interactions are devoid of orderly communications between elements, made possible by feedback loops within the system that do not reciprocate directly with one another.

3. Does self-organization result from applying simple, unwritten rules?

   This implies the elements congeal into some form of organization guided not by a central authority, but by the rules in place. This self-organization continues until reaching a state of self-organized criticality, in which even minor environmental stimuli can cause major disruptions in the system.

4. Do emergent behaviors begin to appear over time?

   Emergent behavior results from the previous chaotic aggregation of elements self-organizing to produce behaviors that were heretofore unpredictable.

5. Does the crowd adapt its behavior through metis?

   Remembering that metis is learning through experience with one's environment, a crowd that modifies its behavior after experiencing environmental inputs can be said to have learned from that experience.

By answering these questions, it is possible to determine if the crowd being observed is a complex adaptive. Given the explanation of complex adaptive systems presented in this thesis, it is possible to derive more in-depth criteria for judging the systemic characteristics of a crowd. However, the five questions posited here are of sufficient breadth and depth to determine if the crowd qualifies as a complex adaptive system.

IV. CASE STUDIES

A. FERGUSON, MISSOURI

Ferguson, Missouri, is a suburb of Saint Louis. With a population just over 67 percent black, almost 25 percent of the population earns an income below the established federal poverty levels as of 2013.[144] Ferguson is a community seen by some as having deep racial divisions, a claim refuted by the city's mayor, James Kowles.[145] But those claims of racial divisions are echoed by residents in the streets. In a statement by U.S. Attorney General Eric Holder, a "highly toxic environment," characterized by deep mistrust of the local police by area residents, has existed for years.[146] This gulf was driven by what Holder described as "explicit racial bias" and the Ferguson Police Department's focus on revenue generation over community protection.[147] Furthermore, federal officials concluded the local court system was focused more on revenue generation than being a fair arbiter of criminal issues, especially those involving the African-American community.[148] These are but a few of the many deep seated issues setting the context for the events of August 2014.

1. Background

On August 9, 2014, at 12:02 p.m. Central Daylight Time, Ferguson Police Officer Darren Wilson initiated an encounter with Michael Brown, an 18-year-old black male who was walking in the middle of Canfield Drive with another man (see Figure 5).

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144 "Community Facts," American Fact Finder, accessed October 9, 2015, http://factfinder.census.gov/faces/nav/jsf/pages/community_facts.xhtml.

145 "Ferguson Mayor: There's No Racial Divide Here," MSNBC video "Live with Tamron Hall," August 19, 2014, 3:12, http://www.msnbc.com/newsnation/watch/ferguson-mayor--theres-no-racial-divide-here-319506499946; Brent McDonald, "Standoff in Ferguson," *New York Times* video, August 14, 2014, 00:46, http://www.nytimes.com/video/us/100000003055806/standoff-with-police-in-ferguson.html.

146 Max Ehrenfreund, "17 Disturbing Statistics from the Federal Report on Ferguson Police," *Washington Post* video, March 4, 2015, 00:40, http://www.washingtonpost.com/news/wonkblog/wp/2015/03/04/17-disturbing-statistics-from-the-federal-report-on-ferguson-police/.

147 Ehrenfreund, "17 Disturbing Statistics," 2:25; U.S. Department of Justice, *Investigation of the Ferguson Police Department* (U.S. Department of Justice, March 4, 2015), 15, http://www.justice.gov/sites/default/files/opa/press-releases/attachments/2015/03/04/ferguson_police_department_report.pdf.

148 U.S. Department of Justice, *Investigation of the Ferguson Police Department*, 3.

Wilson shot and killed Brown when the encounter turned violent.[149] The shooting was the catalyst leading to more than two weeks of violent protests in Ferguson. During that time, protests occurred both day and night. Many protests, mostly those held during the day, were peaceful in nature. However, those held at night were by and large more dynamic and violent.[150]

Figure 5. Canfield Green Apartments and Red's Barbeque

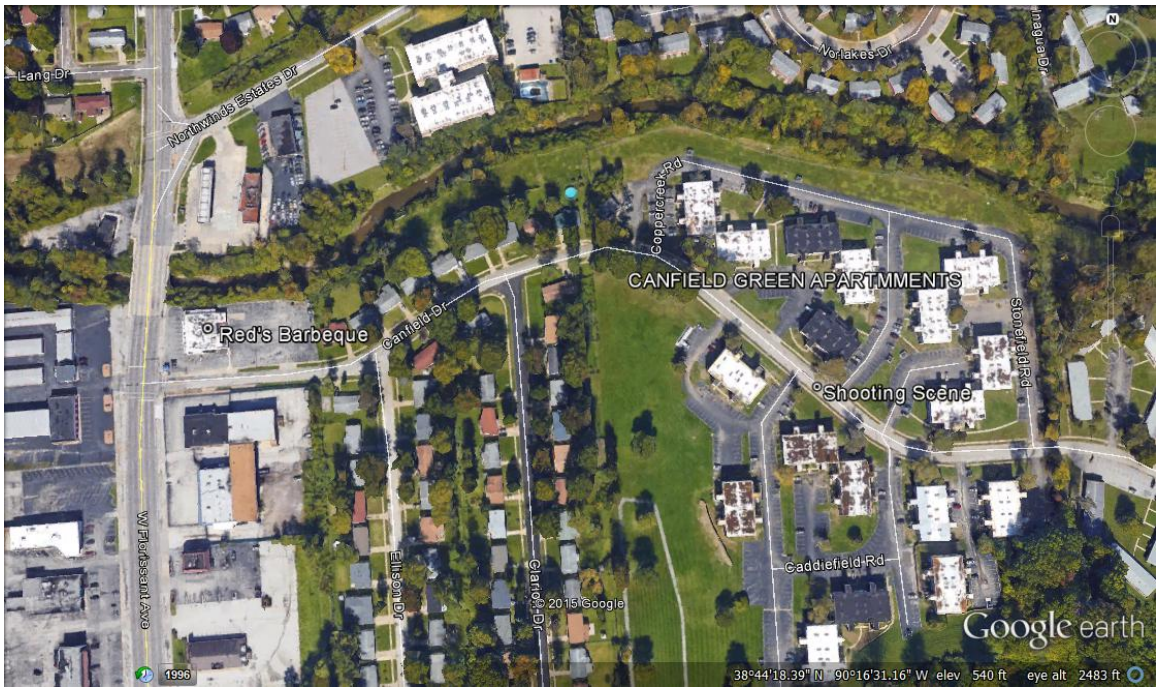

Image from Google Earth

Daylight protests were attended by a variety of local residents; young, old, black, and white. Among the protesters were local community leaders, clergy, and high-profile activists such as Reverend Al Sharpton. Their activities included vigils, marches, and stationary protests in which they held signs and made speeches denouncing unjust police

149 U.S. Department of Justice, *After-Action Assessment*, 5.

150 Ibid., 116.

actions.[151] Many of those peacefully protesting during daylight hours decried the violence that characterized the night, and encouraged those engaged in violence to join them in peaceful protest.[152] Most daytime protesters went home as night approached, not wanting any part of the impending violence. One resident is cited in a Justice Department inquiry into the protests as saying, "Once it got dark…it turned ugly."[153] Another resident interviewed by ABC news commented, "Once the sun goes down, it's like a third-world country that's fighting for liberation."[154]

Nighttime brought a decidedly different character to the protests, which were largely chaotic and violent, featuring looting, arson, gunfire, and assaults on the police who responded with force.[155] These protests attracted many non-residents, who area residents blamed for much of the violence.[156] Groups, both large and small, roamed the streets expressing their outrage in confrontations with law enforcement. A large number took part in lootings, assaults, arson, and other violent actions as the unrest escalated.

Events in Ferguson are presented in this work in the context which they occurred, to achieve a systems perspective. It is unrealistic to examine each and every protest event in Ferguson, given the duration and multiplicity of the riots, not to mention the chaotic milieu they created. Therefore, generalized observations and defining moments in the first thirty-six hours are presented in this work via a case study. These first hours set the tone of the events to follow, and captured the essence and character of the riots. Analysis of the case study begins with the shooting scene.

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[151] Jack Jenkins, "Ferguson Faith Leaders Take to the Streets, March with Protestors," ThinkProgress, August 14, 2014, http://thinkprogress.org/home/2014/08/14/3471361/faith-groups-ferguson/; "Ferguson, Missouri: Inside an American City under Siege," ABC News video, accessed October 12, 2015, 3:50, http://abcnews.go.com/Nightline/video/ferguson-missouri-inside-american-city-siege-25032337.

[152] Jenkins, "Ferguson Faith Leaders."

[153] U.S. Department of Justice, *After-Action Assessment*, 17.

[154] "Ferguson, Missouri," 4:47.

[155] U.S. Department of Justice, *After-Action Assessment*, 17.

[156] David Mattingly, "Outsiders Blamed for Inciting Violence in Ferguson," 22WWLP, August 19, 2014, http://wwlp.com/2014/08/19/outsiders-blamed-for-inciting-violence-in-ferguson/.

2. The Crowd System

As stated previously, Ferguson Police Officer Darren Wilson shot Michael Brown during an encounter on Canfield Drive, near the Canfield Green apartment complex. Approximately twenty minutes after the shooting, Ferguson Police turned the investigation over to the St. Louis County Police.[157] At one point, approximately two hundred people gathered around as police processed the scene.[158] As video evidence reveals, the majority of those gathering were people of color.[159] The evidence also indicates a high level of agitation among those gathered.[160] One officer interviewed during a federal inquiry said he witnessed "a growing and hostile crowd."[161] A number of people were heard yelling at police, questioning the necessity of the shooting and condemning them for not treating Brown's injuries or calling an ambulance, even though it was apparent he was dead. As the crowd and its agitation level grew, police adapted their crime-scene processing procedures to address the growing threat to the integrity of the scene and their safety by calling in more officers, some with police canines.[162]

At 1:17 p.m., St. Louis County Police requested mutual aid through the "Code 1000" plan, a mutual aid agreement among county police agencies invoked for extraordinary events requiring added police presence.[163] This request brought in several more officers from various agencies around the county. During this time, Michael Brown's body was left uncovered in the street in full view of the crowd. This was viewed by many in the gathering crowd as an affront to the African-American community and an attempt to intimidate them.[164] One local elected official asserted that leaving Brown's body in the street "was very disrespectful to the community and the people who live

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[157] U.S. Department of Justice, *After-Action Assessment*, 6.

[158] Ibid., 7.

[159] "Michael Brown Shooting Scene in Ferguson, Mo.!" YouTube video, posted by "Harry Williby," August 16, 2014, https://www.youtube.com/watch?v=SDNIy056DNc.

[160] Betsy Bruce, "Teenager Shot, Killed in Ferguson Apartment Complex," Fox, August 9, 2014, http://fox2now.com/2014/08/09/man-shot-killed-in-ferguson-apartment-complex/.

[161] U.S. Department of Justice, *After-Action Assessment*, 6.

[162] Ibid.

[163] Ibid., 7.

[164] Ibid., 9.

there."[165] You could cut the tension in the air with a knife, one resident commented.[166] The tension increased as more people arrived, informed of the event via social media, an important component of what was to become many days of unrest.[167] Threats of bodily harm against the police could to be heard as tensions escalated. A bystander interviewed by the *New York Times* heard someone in the crowd yell, "Kill the police!" This was in addition to several reports of gunfire around the scene.[168]

A large number of people began to gather at Red's Barbeque, a restaurant located a short distance from the shooting scene, as social media exploded with news about Brown's shooting.[169] Sporadic gunfire could be heard near both Red's and the shooting scene. As a result, at 2:43 p.m., an armored police vehicle arrived to provide protection to the officers.[170] By 3:15 p.m., officers began to arrive and assemble near Canfield Drive, clad in protective riot gear.[171] At approximately 4:00 p.m., four hours after the shooting, Brown's body was removed from the scene by the medical examiner.[172]

The police did not provide any information to the public regarding the circumstances surrounding the shooting while Brown's body lay in the street.[173] This allowed misinformed narratives posted to social and commercial media to shape the event in people's minds. In one early video from the scene, people with no first-hand knowledge of the shooting were heard saying that Brown was shot "for no reason."[174] One woman in the video concurred with this assessment, even though she stated she was

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[165] Julie Bosman and Joseph Goldstein, "Timeline for a Body: 4 Hours in the Middle of a Ferguson Street," *New York Times* video, August 23, 2014, http://www.nytimes.com/2014/08/24/us/michael-brown-a-bodys-timeline-4-hours-on-a-ferguson-street.html.

[166] Ibid., 2:38.

[167] Bosman and Goldstein, "Timeline for a Body."

[168] Ibid., 2:40; U.S. Department of Justice, *After-Action Assessment*, 8.

[169] U.S. Department of Justice, *After-Action Assessment*, 9.

[170] Ibid., 10.

[171] Ibid.

[172] Ibid.

[173] Ibid., 11.

[174] "Michael Brown Shooting Scene in Ferguson, Mo.!," 00:08.

in the shower when she heard the shots.[175] Others on the video quote unnamed sources as having said Brown was shot while trying to surrender, with his hands raised, and while lying wounded on the ground.[176] These claims were later refuted in both the district attorney's and Justice Department's investigations.[177] Nonetheless, misinformation not refuted by the police fueled passions, and more people began to congregate in the area. By 8:40 p.m., police officers were surrounding by a threatening crowd, and were ordered to withdraw from the Canfield Drive area to an alternate staging location on Glen Owen Drive.[178] Twelve hours after the shooting, as midnight approached, people, spurred on by messages over social media, continued to arrive and congregate near the shooting scene.[179]

The next morning, August 10th, began with more people amassing near West Florissant and South Florissant Avenues in front of the Ferguson Police Department. At that time, the crowd changed from being observers to active protesters, sitting down in the street, blocking it in front of the police station.[180] The first instances of looting began in the area of West Florissant Avenue, prompting the police to request additional help from outside the community.[181] Looting spread rapidly and escalated into the first instance of arson when a QuikTrip convenience store was set afire.[182] In response to the violent crowd, estimated to consist of "several hundreds of people," additional armored police vehicles and canines were deployed.[183] After ordering the crowd to disperse, law

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[175] Ibid., 00:50.

[176] Ibid., 5:00.

[177] "Grand Jury Decides Not to Indict Officer Darren Wilson in Shooting Death of Michael Brown," YouTube video, posted by "PBS News Hour," November 24, 2015, 20:05, https://www.youtube.com/watch?v=EuupBHUGbYo; U.S. Department of Justice, *Department of Justice Report Regarding the Criminal Investigation into the Shooting Death of Michael Brown by Ferguson, Missouri Police Officer Darren Wilson* (Washington, DC: U.S. Department of Justice, March 4, 2015), 7, http://www.justice.gov/sites/default/files/opa/press-releases/attachments/2015/03/04/doj_report_on_shooting_of_michael_brown_1.pdf.

[178] U.S. Department of Justice, *After-Action Assessment*, 11.

[179] Ibid.

[180] Ibid., 12.

[181] Ibid.

[182] Ibid.

[183] Ibid.

enforcement was met with defiance, a continuous barrage of thrown objects, and the sound of sporadic gunfire.[184] Police deployed tear gas to disband the crowd and allow firefighters to battle the QuikTrip fire unimpeded by the violence.[185]

As day turned to night, speculation continued to grow among protesters, as the narrative that Michael Brown was killed while trying to escape or surrender spread by word-of-mouth, news outlets, and social media.[186] According to David Karpf, an assistant professor at George Washington University, the police failed to control the emerging message on social media surrounding the shooting.[187] Resultantly, violence continued as protesters clashed with authorities and more than thirty local business establishments were looted.[188]

The events detailed to this point are indicative of what was to follow for many more days and nights. Protestors adapted in response to police control efforts. In some instances, protesters reverted to throwing frozen water bottles at police.[189] Others threw Molotov cocktails, destroyed police vehicles, erected makeshift barricades in the streets, and used social media to coordinate crowd actions and inform others in the community and abroad.[190]

3. Analysis

To explain the behavior of the Ferguson protesters, it is useful to view that behavior in the aggregate, as a system, rather than trying to analyze the behavior of each

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[184] Ibid., 14.

[185] Ibid., 14–15.

[186] Ibid., 14.

[187] Lindsay Deutsch and Jolie Lee, "No Filter: Social Media Show Raw View of #Ferguson," *USA Today*, August 19, 2014, http://www.usatoday.com.

[188] U.S. Department of Justice, *After-Action Assessment,* 15.

[189] Ibid., 16.

[190] McDonald, "Standoff in Ferguson," 2:31; Larry Copeland and Charisse Jones, "Chaos Erupts Again in Ferguson," *USA Today*, August 19, 2014, http://www.usatoday.com/; "Ferguson Protesters Flip, Set Fire to Police Car," YouTube video, posted by "USA Today," November 25, 2014, https://www.youtube.com/watch?v=xejymucKmPw; Kelly Moffit, "How Social Media Is Playing a Role in Ferguson," *St. Louis Business Journal*, August 13, 2014, http://www.bizjournals.com/stlouis/blog/2014/08/how-social-media-is-playing-a-role-in-ferguson.html.

free-thinking, independent individual or element. The system can be broken down into subsystems, each operating independently in a decentralized environment. It can be determined if the crowds in Ferguson qualified as complex adaptive systems by examining evidence gleaned from the case study, then applying the qualifying questions presented on page forty-two of this work. For the purposes of this thesis, two events from the unrest in Ferguson have been selected for analysis—the initial shooting scene, and the gathering at Red's Barbeque Restaurant.

To fully understand what transpired after Michael Brown's shooting, it is necessary to remember U.S. Attorney General Eric Holder's assessment of the relationship between the black residents of Ferguson and the local criminal justice apparatus. Holder characterized Ferguson as a "highly toxic environment," imbued with "explicit racial bias" on the part of police and the courts, who were more interested in using the system as a revenue source than as a fair and unbiased arm of justice.[191] For many years, relations between Ferguson residents and police—of which only three of the fifty officers are black—have been strained.[192] A United States Justice Department report on the Ferguson riots cites a lack of outreach by the police department as contributing to an atmosphere of mistrust and perceived legal inequity against minority residents.[193] Many residents of the nearby Canfield Green Apartment complex viewed Brown's death as just such an inequity. Furthermore, the incident was considered an affront to the African-American community, as information that characterized the shooting as unnecessary spread rapidly via social media.[194]

In a macro sense, the African-American community in Ferguson had reached a state of self-organized criticality, in which a single event, such as the shooting of Michael Brown, provided the catalyst for large-scale disruptive behavior. What followed in the

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[191] Ehrenfreund, "17 Disturbing Statistics from the Federal Report on Ferguson Police," 00:20.

[192] Katie Sanders, "Ferguson, Mo., Has 50 White Police Officers, Three Black Officers, NBC's Mitchell Claims," PunditFact, August 17, 2014, http://www.politifact.com/punditfact/statements/2014/aug/17/andrea-mitchell/ferguson-police-department-has-50-white-officers-t/.

[193] U.S. Department of Justice, *After-Action Assessment*, xix.

[194] Ibid., 97; "Michael Brown Shooting Scene in Ferguson, Mo.!" 00:55.

immediate aftermath of the shooting deserves examination as it marked the start of the unrest. For that reason, this analysis starts at the shooting scene itself.

Applying the qualifying questions presented earlier, we must determine if a central authority was present, controlling multiple elements within the crowd. Video and written records of the scene clearly indicate many people (elements) gathered at the scene. As stated earlier, some estimates were as high as two hundred. The homogeneity of the gathering crowd might suggest a central node of control, yet there was no noticeable locus of control for those gathered. While some in the crowd tended to be more vocal than others, they were not necessarily controlling the actions of those who gathered. With no central authority, the actions of the crowd appeared chaotic and nonlinear. That is to say, their interactions did not follow any logical order leading to any overall terminus. Multiple feedback loops were present. Some feedback loops appeared to reinforce and perpetuate the narrative emerging from the scene, while others reinforced emerging behaviors, as evidenced by people joining in the chorus to criticize police. As people vocally expressed their criticisms, their actions were reinforced by others approving and joining in, a manifestation of a positive feedback loop.

Next, it must be determined if self-organization resulted from unwritten rules governing the participants' interactions. Examining the evidence reveals those rules did exist; the rules involved concurring with the emerging narrative, and perpetuating that narrative in subsequent interactions. Openly criticizing police and avoiding any praise of law enforcement officials were also unwritten rules, reinforced by positive feedback loops. Adherence to these rules created solidarity among the crowd, leading to self-organization as more people began to coalesce around the central theme that law enforcement was an unjust oppressor, as evidenced by Brown's death.

Emergent behaviors began at the shooting scene as, over time, the crowd became more organized. Adherence to the unwritten rules, and the nonlinear interactions among those gathered, gave way to self-organization and emergent ire directed at the police.[195] That ire took the form of taunts and insults, punctuated by the sound of nearby gunfire.

[195] U.S. Department of Justice, *After-Action Assessment*, 6.

This self-organization and emergent behavior was facilitated in part by an adaptation—using social media for communication among the crowd. This left police flatfooted as they struggled to keep pace with the rapid emergence of a false narrative.

In time, law enforcement brought in additional resources in the form of police canine teams to counter the burgeoning crowd, fueled by the narrative and collective anger. According to a federal review, the presence of the canines invoked images among the crowd of government oppression and the civil rights riots of the 1960s.[196] This caused increased tensions among the gathering, which still had no identifiable leadership, but was self-organizing around unwritten rules and displaying emergent, unpredictable behaviors.

Metis is the final element in determining if this crowd qualified as a complex adaptive system. Metis, as previously explained, is learning through experience with one's environment. As more people gathered on West Florissant Avenue, they began to learn through environmental inputs generated at the scene. Those inputs included the unwritten rules reinforced through feedback loops, which in turn governed behavior *en masse*. People learned what happened to Michael Brown and learned what behavior was accepted and expected.

The duration of the overall protests in Ferguson, coupled with their distinct day/night characteristics, added levels of complexity unmatched by most civil disturbances. Most crowd control incidents are shorter in duration and less violent, an observation made by researchers at the University of Essex who stated, "The severity of riots is inversely proportional to their frequency."[197] Given this is the case, it makes sense to also focus on a smaller, less volatile event in this work, since it is more indicative of the majority of crowd control situations.

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[196] Ibid., 43.

[197] "How Riots Behave Like Forest Fires," Discovery.com, August 10, 2011, http://news.discovery.com/human/london-riots-psychology-pattern-wildfires-110810.htm.

B. 2004 BOSTON RED SOX WORLD SERIES WIN

In October of 2004, Major League Baseball's World Series culminated with the Boston Red Sox sweeping the St. Louis Cardinals. It had been eighty-six years since the Red Sox had won the world championship, and the city was primed to celebrate. What started out as a night of raucous celebration turned into a night of civil unrest, resulting in more than three dozen arrests.[198]

1. Background

Sports-related civil unrest is not uncommon, nor a localized phenomenon. Riotous behavior has occurred at European football matches for many years, and is currently surging at football stadiums across Europe as economic woes and nationalism spread across the continent.[199] In Canada, hockey fans rioted in Vancouver, British Columbia, after the Boston Bruins beat the Vancouver Canucks to win the National Hockey League championship in June of 2011. Vancouver saw automobiles overturned and set afire, windows smashed, and people hurling projectiles at police who tried to quell the violence.[200] Despite city leaders preemptively attempting to control the crowd by providing a venue for fans to watch the game, heavy alcohol consumption and the team's loss sparked unrest that left many arrested and injured.[201]

Across the United States, there are scores of riotous incidents borne out of sporting events.[202] Among them are the 1999 post-Super Bowl riot in Denver, where several were arrested and injured amid clouds of police tear gas, and the unrest that rocked San Francisco after the Giants won the World Series in 2010, when fans lit fires

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198 "39 Arrested during World Series Celebration," City of Boston, October 28, 2004, http://www.cityofboston.gov/news/Default.aspx?id=2354.

199 Cameron Kesel, "Top 10 Most Insane Soccer Riots in History," TopTenz, May 11, 2013, http://www.toptenz.net/top-10-most-insane-soccer-riots-in-history.php; Naftali Bendavid, "Soccer Violence Escalates in Europe," *Wall Street Journal*, April 29, 2015, sec. World, http://www.wsj.com/.

200 Melanie Nagy, "Riots Erupt in Vancouver after Canucks Loss," CBC News, June 15, 2011, http://www.cbc.ca/news/canada/british-columbia/riots-erupt-in-vancouver-after-canucks-loss-1.993707.

201 Furlong and Keefe, *The Night the City Became a Stadium*, 14–15.

202 Matt Stevens, "When Games Give Way to Violence," *Los Angeles Times*, June 16, 2011, http://articles.latimes.com/.

and blocked traffic.[203] The city of Boston has endured numerous sports-related incidents of unrest. Among the worst occurred in 2004, when two people lost their lives in separate incidents.[204] One man, James Grabowski, was killed after being struck by an automobile that had inadvertently journeyed onto a street blocked by revelers celebrating the New England Patriots' Super Bowl win that day.[205] Victoria Snellgrove was killed near Fenway Park, home of the Boston Red Sox, when violence erupted in the streets following the Red Sox game-seven playoff win over the rival New York Yankees. Snellgrove was killed in the melee when accidentally struck in the eye by a "non-lethal" projectile fired by police.[206] The Snellgrove incident cost the city $5 million in a wrongful death suit.[207] Her death occurred just days before the Red Sox won the championship, which saw its own post-game unrest. Four years after the tragic deaths of Grabowski and Snellgrove, another fan, David Woodman, died during a raucous celebration of the Boston Celtics' National Basketball Association championship victory. That celebration necessitated platoons of police, some on horseback, to control the crowd.[208] Woodman died after struggling with police outside the team's home court. His death cost the city $3 million in legal damages.[209]

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[203] Stevens, "When Games Give Way."

[204] Scott Malone, "Boston Plans Heavy Police Presence to Avoid Post-Super Bowl Chaos" *Reuters*, January 30, 2015, http://www.reuters.com/.

[205] "One Killed in Boston's Patriots Celebration," ESPN, February 3, 2004, http://sports.espn.go.com/nfl/playoffs03/news/story?id=1725220.

[206] Thomas Farragher and David Abel, "Postgame Police Projectile Kills an Emerson Student," Boston.com, October 22, 2004, http://www.boston.com/sports/baseball/redsox/articles/2004/10/22/postgame_police_projectile_kills_an_emerson_student/?page=full.

[207] Shelly Murphy, "Snelgrove Family Settles Wrongful Death Suit," Boston.com, July 14, 2006, http://www.boston.com/news/local/massachusetts/articles/2006/07/14/snelgrove_family_settles_lawsuit/.

[208] "Boston Celtics 2008 NBA World Champions," You Tube video, posted by "Ryan Dowdy," June 18, 2008, 3:45, https://www.youtube.com/watch?v=EPztabtnjS4.

[209] Barry Leibowitz, "Boston Celtics Fan Died in '08 Celebration; Parents Win $3 Million Suit vs. City," CBS News, June 18, 2010, http://www.cbsnews.com/news/boston-celtics-fan-died-in-08-celebration-parents-win-3-million-suit-vs-city/.

2. The Crowd System

On October 28, 2004, the Boston Red Sox secured the World Series title, defeating the Cardinals in St. Louis.[210] Within moments of the last out, streets around Boston's Fenway Park became jammed with thousands of fans spontaneously celebrating the victory.[211] Video taken at the scene shows a tidal wave of people surging down Boylston Street, adjacent to Fenway Park.[212] Many of these people came from several nearby colleges and universities. Still more spilled out of the numerous bars and restaurants catering to the sports crowd along Boylston Street (see Figure 6).

Figure 6. Fenway Park Area

Image from Google Earth

As the crowd converged outside of Fenway Park, there appeared to be no central guiding authority, no single entity directing crowd movements or behaviors. Spurred on

210 Dan Shaughnessy, "YES!!!," Boston.com, October 28, 2004, http://www.boston.com/sports/baseball/redsox/articles/2004/10/28/yes/.

211 "Red Sox Master Video," Compact Disc Video, Massachusetts State Police Crime Scene Services, 2004.

212 "Red Sox Master Video."

by the natural locus of the team's home field and social media, fans packed tightly in the street, stopping all traffic. As more and more people flooded the scene, it was apparent there was no particular plan of celebration, no focus of activity upon which the crowd could turn its attention. Although there appeared to be small, cohesive groups within the crowd, identified by their walking closely together and conversing, the overall crowd lacked orderly communications. Most communications were in the form of excited gestures, such as jumping up and down and waving hands in the air, or shouting popular Red Sox slogans. Some in the crowd expressed themselves by simply screaming at the top of their lungs. While this behavior was random and chaotic, with no particular order to its intended propagation, it nonetheless served as a mode of communications.

The crowd's heightened state of arousal at their team's victory was evident. People began to excitedly gather around attractors, such as others waving brooms in the air, a reference to the Red Sox four-game sweep of the series.[213] These symbolic attractors became a catalyst for self-organization. Emergent behaviors began to appear out of that organization, where small groups would begin to jump up and down, waving their hands in the air and shouting. Another emergent behavior was that of chanting popular team related slogans. "Let's go Red Sox!" reverberated through the chilly night air, with more and more people joining in the chorus before it would eventually die out, only to start again later.

The areas of greatest activity drew more crowds. This created more self-organization as people began to congeal around loci of emergent activity and emulate the behaviors present, spawning other emergent behavior. At one point, several young women riding atop the shoulders of men, bared their breasts to the predominantly male crowd, drawing frenzied cheers. One of these women was assaulted while repeating the gesture, as hands reached out of the crowd and groped her chest, inciting a fight. This served to excite the crowd further, drawing them closer to a state of self-organized criticality.[214] The revelry continued unchecked despite the presence of police, who remained on the sidewalk.

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[213] Ibid., 6:25.

[214] Ibid., 13:00.

Emergent behaviors continued as small pockets of organization formed. Behaviors included igniting fireworks, and body surfing, an activity that requires cooperative effort.[215] A short time later, a shirtless man climbed up a light pole to the screams and cheers of those below, before bottles were hurled at him, an indication of potential violence in the offing.[216] All these behaviors continued to contribute to the building of self-organized criticality, where a small event, a minor perturbation, had the potential to trigger an avalanche of violence. As the crowd chanted "block those streets!," police took action in the face of impending, widespread civil unrest. Police horses took to the street, followed by a phalanx of state police officers adorned in hard-shell protective riot gear.[217] The crowd's tenor changed in the face of the police stimulus. The mood of those in close proximity to the show of force became tempered as they backed away, less expressive than before.[218] The crowd hurled bottles at police as the formation moved forward.[219] This was an indication that the stimulus provided by police action disturbed the system enough to result in adaptive, emergent behavior.

The police formation continued to move slowly forward, stopping every several yards to allow the crowd a chance to leave the area. When it appeared the police would do nothing more than repeatedly advance and stop, many in the crowd began to emulate their earlier behaviors. This emboldened one in the crowd to lie in front of the advancing line, an apparent show of defiance. He was immediately seized by an arrest team that sprang from behind the advancing police line.[220] The arrest caused many in the crowd to scatter in panic. The police were quick to adapt to the change in available space by moving forward and seizing it.

As police continued their advance-stop-advance tactic, the crowd would act in kind, copying the stopping-and-moving behavior down Boylston Street, an indication of

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[215] Ibid., 15:30, 16:40. Body surfing is an activity where a person will lie out flat and be hoisted overhead and passed along over the heads of others on the ground.

[216] Ibid., 19:05.

[217] Ibid., 21:32.

[218] Ibid., 22:30.

[219] Ibid., 23:25.

[220] Ibid., 27:12.

metis by the crowd. It appeared that much of the celebratory mood preceding the police action had shifted to one of consternation as the crowd focused its attention on the police. Celebratory chants had changed to "Please don't shoot us!"—a reference to the death of Victoria Snellgrove—and "Hell no, we won't go!"[221] As the line continued to advance, those near the front of the crowd were more passive than those further back, who continued their celebratory behavior, uninfluenced by the perturbation of police presence, indicating the presence of sub-systems.[222] This went on for nearly an hour before the crowd was finally dispersed.

It should be noted that the state police involvement in the post-series victory celebration was one part of a larger operation spearheaded by the Boston Police Department. The state police were assigned the Boylston Street area, while Boston and several local police consortiums were assigned to other areas around Fenway Park. In all, the police arrested thirty-nine people on various charges.[223]

3. Analysis

Unlike the Ferguson riots, the 2004 Boston Red Sox World Series celebration on Boylston Street was a singular event, transpiring in the course of just over an hour. Also unlike Ferguson, it was contained to a relatively small area. Regardless of the breadth of activity or geography when comparing the two, the qualifying questions of what constitutes a complex adaptive system can still be applied.

First, was the crowd composed of multiple, independent elements that lacked central control? The evidence suggests this is the case. As thousands converged on Boylston Street, there was no recognizable central authority directing their actions. While small cohesive bands of people did appear to exist among the throng, their controlling influence on the overall mass was non-existent. Because those bands of people lacked influence, they must be considered to be no more than a single element of the crowd. The

[221] Ibid., 31:20, 33:25.

[222] Ibid., 35:00.

[223] "39 Arrested," City of Boston.

sporadic and spontaneous character of the crowd appeared devoid of rational thinking or rational rules of interaction. It was, in essence, a free-for-all.

Second, were interactions among the elements of the crowd characterized by nonlinearity? Put another way, were orderly communications existent, where feedback loops facilitated a message-and-response structure between elements of the crowd? Evidence suggests there was very little organized interaction. What small amount there was had a negligible effect on the overall assemblage. Therefore, nonlinearity of communication can be said to have existed among the crowd on Boylston Street.

We must then ask if unwritten rules lead to self-organization? This would entail elements of the crowd self-organizing, not from a central authority commanding them to do so, but out of unwritten rules governing behavior. One unwritten rule that was clear that night was support for the Red Sox. Whether shouting "Let's go Red Sox!" or wearing team-branded clothing, carrying a sign supporting the team or a broom symbolic of the series sweep, it was clear the vast majority of those present were Red Sox supporters. Support of another team, especially the rival New York Yankees, would likely have yielded a swift and unambiguous rebuke from the crowd, providing stimulus for an avalanche of violent behavior in a system already on the cusp of self-organized criticality. Another unwritten rule was disregard for personal space. While there is no agreed-upon distance that constitutes a personal space violation, it should be noted that the idea of personal space is "moveable territory."[224] To participate in this event was to do away with one's expectation of personal space. Failing to do so would certainly preclude one from participating, as the event involved standing in the crowded street, shoulder-to-shoulder with strangers.

A forth qualifying question is whether emergent behavior resulted from self-organization? The video of Boylston Street revealed a number of behaviors emerging from pockets of self-organization. The most prevalent behavior was people gathering in smaller groups and emulating similar behaviors, such as jumping up and down, waving hands in the air, and chanting team slogans. This behavior would start with just one or

[224] Kenneth V. McDowell, "Violations of Personal Space," *Canadian Journal of Behavioural Science* 4, no. 3 (1972): 210.

two people acting as attractors, and others would soon join in, mimicking the behavior. Every observed incident of this behavior was transient, ending within a short time, only to be repeated elsewhere in the crowd.

Another emergent behavior resulting from self-organization was chanting in unison. There were several examples of groups chanting team slogans and slogans indicative of defiance against police attempts at controlling the crowd. “Please don’t shoot us!,” “Hell no, we won’t go!,” and “Block those streets!” all spontaneously emerged, made possible by small, self-organized groups within the mass.

Finally, did the crowd adapt its behavior through the process of metis? It is through metis, or learning, that adaptation is possible.[225] Sagarin saw how parallels could be drawn between sea life adapting for survival and humans adapting tactics in fighting terrorism. Both adapt through learning inputs from the environment. He posits that “Natural organisms don’t plan, predict, or try to be perfect.”[226] The crowd that appeared on Boylston Street that night did not plan, predict, or try to perfect their celebrations; it therefore stands to reason that subsequent emergent behaviors resulted through metis. The elements of the crowd learned behaviors that were acceptable within the framework of the system by exposure to, and learning from, environmental inputs. Those present learned the unwritten rules of supporting the Red Sox and eschewing personal space restrictions by observing others in the crowd. Crowd members adapted their behavior to conform to other elements of the crowd. Using Sagarin’s philosophy, one can see how the crowd is similar to a school of fish, in which decentralized control relies upon the elements sensing the environment and adjusting their behavior accordingly.[227] Metis was evident throughout much of the Boylston Street video, but never more so than when the police took to the street to control the crowd. Many in the crowd received this sensory input and adapted their behavior. No longer were they boisterously celebrating; rather,

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[225] Sagarin, *Learning from the Octopus*, 35.

[226] Rafe Sagarin, “The Rules of Adaptability,” YouTube video, January 18, 2013, 00:13, https://www.youtube.com/watch?v=ZOakkaEK5QM&list=PLLqo3zIxhSEIdE-93urRbfsC6ewcsMA8R&index=5.

[227] Sagarin, *Learning from the Octopus*, 66.

they were sheepishly trying to melt into the fabric of the crowd—a radical departure in behavior undertaken by multiple independent elements of the crowd.

Still, there were those who carried on tumultuously in the presence of police. Since there was no centralized authority within the crowd dictating behavior, the system continued to act in diverse, unpredictable ways, as evidenced by the young man who lay down in front of the police line and was arrested. The environmental input of advancing police was viewed as a threat to elements of the system, providing a negative feedback loop leading them to back away to avoid arrest. By backing away, the crowd gave up space, which was quickly taken by law enforcement. Subsequent arrest team intrusions into the crowd yielded further retreat, an adaptive behavior learned to avoid arrest. None of this behavior was planned or predicted. Such is the perplexing character of a complex adaptive system.

C. KEENE, NEW HAMPSHIRE, PUMPKIN FESTIVAL

Started in 1991, the Keene, New Hampshire, Pumpkin Festival was established to "bring new life and vitality to a downtown that seemed on the verge of collapse."[228] The festival's main attraction was the tens of thousands of pumpkins carved into jack-o-lanterns for Halloween. As stated on the event's official website, "The heart of the Pumpkin Festival lies in the pumpkins."[229] The site goes on to say, "The Pumpkin Festival has been broadcasting to the world what can happen when people come together for no other purpose than making magic happen."[230] Those words would prove to be prophetic at the 2014 Pumpkin Festival.

1. Background

On October 18, 2014, Keene held its twenty-third annual Pumpkin Festival. The festival has always been a docile event, attracting thousands of people every year. The 2014 event drew families, artists and pumpkin fanatics from around the northeast. That

[228] "History," Pumpkin Festival 2015, accessed November 10, 2015, http://www.pumpkinfestival 2015.org/index.php/history/.

[229] "History," Pumpkin Festival 2015.

[230] Ibid.

same year, pumpkin carving artisans were trying to break their own *Guinness Book of World Records* mark of 30,581 carved masterpieces.[231]

The Pumpkin Festival had also been a day on which college students from nearby Keene State College hosted parties, with guests coming from far and wide to celebrate the event. From viewing police logs chronicling the events of August 18, 2014, it is apparent that some of those later arrested came from as far away as Connecticut.[232] Social media played a large role in drawing a larger-than-usual amount of party-goers to the 2014 festival.[233] City leaders pointed to one particular social media site, FinnaRage TV, as encouraging party-goers to flock to Keene for the purpose of "raising mayhem."[234] One alcohol-fueled party located near the school escalated into a frenzied spate of violence, as hundreds of college-aged people spilled into Winchester Street (see Figure 7), setting fires, overturning vehicles and dumpsters, smashing windows, and committing assaults.[235] The mayhem grew to include an estimated four thousand people, according to one witness, although police put the estimate at around two thousand.[236] Law enforcement authorities found themselves vastly outnumbered and resorted to using pepper spray, tear gas, canines, and other methods to regain order.[237]

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[231] Alyssa Edes, Jeremy C. Fox, and Kanno-Youngs Zolan, "Disturbances Continue after Parties Spin out of Control in Keene, N.H.," *Boston Globe*, October 18, 2014, https://www.bostonglobe.com/.

[232] "Police Log," City of Keene, October 18, 2014, 12, http://www.ci.keene.nh.us/node/90805.

[233] Steve Cooper and Kimberly Bookman, "84 Arrested after Keene Riots, More Arrests to Come," WHDH, December 1, 2014, http://www.whdh.com/story/26834201/84-arrested-after-keene-pumpkin-riots-more-arrests-to-come.

[234] Jack Rodolico, "Is Party Company 'FinnaRage' To Blame For Keene Riots?," NPR New Hampshire, October 20, 2014, http://nhpr.org/post/party-company-finnarage-blame-keene-riots.

[235] "N.H. Police Restore Calm after Pumpkin Festival Dissolves into Riot (+video)," *Christian Science Monitor*, October 19, 2014, http://www.csmonitor.com/USA/Latest-News-Wires/2014/1019/N.H.-police-restore-calm-after-pumpkin-festival-dissolves-into-riot-video.

[236] Edes, Fox, and Zolan, "Disturbances Continue."

[237] Pepper spray and tear gas are lachrymatory riot control agents (RCA), which cause harmless tearing and intense pain in the eyes.

Figure 7. Keene State College Area

Image from Google Earth

2. The Crowd System

There are a number of videos showing portions of the unrest in Keene that day and into the night. Nearly all showed large numbers of college-aged people amassing spontaneously at outdoor parties and in the streets. The videos also showed a lack of coordination among the crowd—some people ran about wildly, while others stood idly by, cheering on the people who overturned automobiles and danced atop them.[238] Other party-goers tore down street signs.[239] These destructive acts attracted others, who gathered to cheer on the vandals, or join in the destruction. At no time in the videos was anyone seen attempting to stop the destruction of property. Alcohol was a key contributing factor to the unrest as widespread binge drinking was evidenced in the videos. Further video analysis revealed partiers throwing rocks and bottles at each other

238 "Pumpkin Festival Riot: Dozens Injured, Arrested near College in New Hampshire," YouTube video, posted by "Gloria Everhart," October 19, 2014, 00:10, https://www.youtube.com/watch?v=LWvD_geg9j4.

239 "Keene State College Pumpkinfest Riot 2014," You Tube video, posted by "Cullen Maher," October 18, 2014, 00:01, https://www.youtube.com/watch?v=IkWoTrhDsyc.

as participants in two large parties faced each other in a friendly but dangerous street battle.[240] Others were observed throwing projectiles at police as fires burned in the streets.[241]

Small, self-organized groups were observed within the larger Keene crowd. These small groups appeared to have little organizational effect on the overall crowd. Elements of the crowd were seen running in panic as police approached, attempting to control the disturbance. Police dispersed tear gas and pepper spray for those crowd elements reluctant to leave the area.[242] In response, members of the crowd lit a large fire in the middle of Blake Street, attracting a larger crowd, which continued drinking and carousing until catching the attention of police. Upon their arrival to break up the crowd, police were met with a barrage of bottles and rocks thrown by those reacting to the presence of law enforcement.[243] Police resorted to using chemical agents, causing the crowd elements to disperse in disarray. Once the crowd was dispersed in one place, the elements of that crowd joined in with other crowds, or simply re-formed in a different location. The crowd was proving to be an adaptable antagonist for law enforcement and public order.

3. Analysis

The riotous crowd that gathered at the 2014 Keene Pumpkin Festival was unexpected, an anomaly, given the history of the event. Establishing if this crowd was a complex adaptive system requires analyzing it within the framework established by the qualifying questions presented earlier in this work.

First, did the crowd contain multiple independent elements devoid of central control? Video analysis reveals the unruly crowds in Keene largely consisted of unrelated, independent elements, most of which were individuals or small groups of

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240 "Keene Pumpkin Fest Riots 2014," 00:01.

241 "30 Injured When Pumpkin Festival Turns to Mayhem," WCVB video, October 19, 2014, 2:23, http://www.wcvb.com/news/30-injured-when-pumpkin-festival-turns-to-mayhem/29221310.

242 "30 Injured," 1:45.

243 Ibid., 1:15.

acquaintances.[244] Further analysis determines there was no central governing node regulating crowd behavior, which led to a lack of cohesiveness among the mass. The college age of the crowd, and heavy alcohol consumption, were the only common bonds indicating any homogeneity.

Were crowd interactions characterized by nonlinearity? Interactions were, indeed, chaotic, with no established order to communications among crowd elements. Most verbal communication was not directed at anyone in particular, resulting in multiple feedback loops in which random people communicated with one another using verbal or expressive means containing multiple messages. Nonlinearity in interactions among the crowd yielded no formal communications channels in which a message sender was acknowledged by an intended receiver through a feedback loop. There would have been overall organization in the crowd had formal, linear communications channels existed.

Was there any organization in the unruly Pumpkin Festival crowd in Keene? To answer this question, it must be established if unwritten rules led to the crowd's self-organization. All evidence examined revealed alcohol consumption was one such unwritten rule. Many students can be seen gathering and drinking heavily in video recordings of the event. This unwritten rule served as an attractor for organization in the crowd. Another unwritten rule was to gather in the street. While the parties that helped fuel the unrest occurred on private property, taking to the street was acceptable behavior under the circumstances. Giving up one's expectations of personal space was a final unwritten rule. Crowds of people were observed gathered shoulder-to-shoulder in the streets and at private outdoor parties, giving up their personal space to participate in the event. The unwritten rules of alcohol consumption, taking to the streets, and giving up personal space combined to create an environment conducive to self-organization.

Video analysis revealed self-organized crowds surging *en masse* through the streets of Keene without purpose or destination. As the crowd moved, it acted as an attractor, resulting in further self-organization, evidenced by others seen joining in the movement. Another example of self-organization was the friendly street battle between

[244] As in the Red Sox case study, small groups had no controlling effect on the overall crowd, and are considered here to be no more than elements of the crowd.

two groups hurling rocks and bottles at each other. Analysis revealed that this game had rules—objects were lobbed high in the direction of the opponent, giving them time to avoid the incoming danger.

Did unpredictable, emergent behavior result from self-organization? Evidence shows such behavior resulted from pockets of self-organization. Overturning automobiles was one such behavior, which could only be accomplished by organizing enough people to accomplish the task. Once overturned, the vehicles acted as attractors, where revelers danced atop them to the cheers of those gathered to watch. Additionally, videos reveal a number of instances where groups of vandals overturned dumpsters, tore street signs from the ground, and lit fires in the streets, which served as attractors around which dozens of people gathered. Behavior adaptations also emerged. When police arrived to quell the unrest, several in the crowd hurled bottles and rocks at them before fleeing with the crowd. Fleeing from law enforcement was an adaptive behavior of the crowd that resulted from a stimulus in the environment—the police, who had the power to be a negative reinforcer through arrest.

Did the crowd adapt through metis? Yes. Elements of the Pumpkin Festival crowd learned through interaction with the environment. One example was learning the unwritten rules of behavior by observing the actions of others. Once partiers began taking to the streets, others learned it as an accepted unwritten rule, which in other circumstances would not have been followed. How to react to the approach of police was another emergent behavior facilitated by self-organization and metis. This behavior was event-specific, meaning it was dictated by the immediate actions of police. If police formations were actively advancing on a crowd, the crowd elements would scatter in an attempt to avoid arrest. The crowd stood their ground if the police formations remained stationary, knowing through metis that the police did not present an immediate threat of incarceration. Metis also played a role in acts of vandalism carried out by small groups in the crowd. Those groups learned through interaction with the environment that there was safety in numbers, which provided the cover needed to damage property without fear of arrest. Overturning automobiles was one example of this phenomenon. Videos show self-organized crowds which learned from the actions of others. They learned it was

acceptable behavior to overturn vehicles, which would otherwise have been unacceptable. The same can be said of throwing objects at police. Police actions provided a stimulus to the crowd, which was in a state of self-organized criticality, resulting in tumultuous behavior. As one person threw an object, others in the crowd learned through that environmental stimulus it was acceptable to follow suit. It was also an adaptive behavior to keep police at bay, and express enmity toward authority.

Having analyzed the evidence within the framework of the qualifying questions, it is clear that the crowd at the 2014 Keene Pumpkin Festival constituted a complex adaptive system.

D. COMMONALITIES

The case studies provided in this thesis represent the types of encounters in which police may engage when confronting unruly crowds. There were a number of similarities between the cases studied when analyzed within the framework of a complex adaptive system. To identify commonalities between the case studies, the same qualifying questions used in those studies are employed.

1. Independent Elements and Central Control

Crowds in all three locations—Ferguson, Boston, and Keene—contained multiple independent elements lacking centralized control. During the first hours of the Ferguson riots, hundreds of people gathered at the scene of Michael Brown's shooting, at Red's Barbeque, and in front of the Ferguson Police Department building. Previous analysis showed these people were independent elements, acting on their own without coordination. Each person was free to express themselves as they pleased, and move about wherever they wished without anyone, or anything, telling them to do so. As events turned violent, independent actors, some in small groups, committed criminal acts on their own volition. There was no central authority compelling people to throw objects at the police, loot stores, or commit acts of arson.

When viewed from a systems perspective, the crowds in Ferguson and Boston contained similar composition and control characteristics, despite differences in their

antecedents. The Boston crowd was comprised of multiple independent elements, acting on their own, without central control. Video analysis of Boston showed thousands of people streaming onto Boylston Street from all directions. There was little cohesion among the crowd, except for an affinity for the Red Sox. No over-arching authority directed the crowd's actions. As in Ferguson, this led to independent actions by various elements in the crowd, including throwing bottles at police, chanting team-supportive slogans, and body surfing.

With respect to its makeup and control, the crowd in Keene exhibited the same characteristics as those in Ferguson and Boston. There was little or no cohesion among the crowd; small groups formed, but they had a negligible effect on the overall crowd's behavior. Like the previous two case studies, no controlling entity dictated the crowd's behavior.

2. Nonlinear Interactions and Feedback Loops

All three case studies involved crowds characterized by nonlinear interactions and communications feedback loops. In Ferguson, the riotous crowd exhibited nonlinear interactions as evidenced by unrestrained, uncoordinated violence resulting from the lack of linear communications among crowd elements. Linear communications would have resulted in more coordinated crowd actions. Analysis also revealed many people moving about in the streets, with little coordinated verbal or non-verbal communications among them. What little coordinated interaction existed did so without meaningful effect on the crowd. The Boston event was similar—crowds of people swarmed the streets in an uncoordinated manner. There appeared to be no linear communications driving any sort of decisive action on the part of the crowd gathered on Boylston Street. People flocked to the Fenway Park area, a locus of celebratory activity, and milled about excitedly, expressing their joy of victory to no one in particular, but often receiving reaction from strangers via feedback loops.

The unruly Pumpkin Festival crowd was smaller than the crowds in Ferguson and Boston, yet still possessed characteristics of those larger crowds. Behavior similar to nonlinear interactions seen in Ferguson and Boston included exuberantly shouting aloud,

which resulted in multiple feedback loops yielding various responses. Lack of continuity in crowd actions also indicated a lack of formal, linear communications needed for a controlling element to exercise direction over the crowd.

Nonlinear interactions existed in the nascent stages of each case studied. Over time, those interactions gave way to greater linear characteristics as multiple, independent elements began to self-organize. Self-organization was seen in multiple acts of violence or celebration, in which small groups congealed due to greater linearity in their interactions.

3. Self-Organization and Unwritten Rules

The Ferguson, Boston, and Keene case studies yielded evidence of self-organization resulting from unwritten rules of behavior. While all three crowds started without coordination, direction, or meaning, they were able to self-organize in pockets through unwritten behavioral rules. The Ferguson riots provided many examples of this phenomenon, as crowds of people banded together to face down police formations in the streets. This was made possible by the unwritten rules of identifying with other protesters and showing defiance to police actions. Boston and Keene saw similar actions, in which chaotic elements, following unwritten rules of behavior, congealed into cohesive units. In Boston, the crowd gathered to face down the police line that was trying to get them to move. This too was regulated by the unwritten rules to seek safety from arrest in the company of others, and to defy police directives. Boston was unique in that it was the only case study in which body surfing occurred, requiring coordination through self-organization.

Perhaps the most bizarre example of self-organization around unwritten rules was the friendly street fight in Keene, in which people at two neighboring parties squared off in the street to hurl rocks and bottles at one another. This involved organizing sides, gathering bottles, and throwing them at the opposition. The unwritten rules involved accepting some element of danger in this folly, lobbing the projectiles in a manner that gave the other side time to react, and to simply not get struck by a projectile.

Keene also saw instances of self-organization in which groups banded together to overturn automobiles. This behavior required the group elements to act in unison while adhering to the unwritten rules, in this case, accepting a role in the action, or watching it with no intention of trying to stop it.

All three case studies saw transient self-organization in which groups formed for some fleeting purpose, such as overturning an automobile, and then dissolved into the crowd. However, the reasons for unrest in Ferguson created larger, more volatile self-organization with greater staying power.

4. Emergent Behavior

Emergent behavior resulting from self-organization in crowds was present in Ferguson, Boston, and Keene. In some cases, those behaviors were adaptations to stimuli in the environment. In Ferguson, that stimulus was the perception of police militarism, which yielded violent confrontations with law enforcement. The Ferguson crowd erected burning barricades in the streets, hurled rocks and bottles, and threw tear gas canisters back at the police. Other riotous behaviors emerged as elements of the crowd continued to self-organize. The most virulent examples of that behavior were when organized groups of people spontaneously looted businesses, blockaded roads, and battled police.

Boston saw neither the widespread violence of Ferguson nor the rampant vandalism of Keene, but did witness emergent behavior. The spontaneous cheering emanating from groups along Boylston Street, and the emergence of body surfing, all resulted via self-organization. The bottles hurled at police were a crowd adaptation to law enforcement attempts to clear the streets. Police efforts to do the same in Keene yielded similar adaptive behaviors from the crowd.

Most emergent behavior was fleeting, lasting only as long as the self-organized group existed. Ferguson, however, did experience longer-duration emergent behaviors, especially violent behaviors, as police were not able to easily disperse the crowds. This was due in part to adaptive behaviors of protesters, such as engaging in the most violent protest actions under cover of night.

The use of social media was another emergent behavior common to the case studies. Social media proved to be an attractor around which others would coalesce. In Ferguson, it provided a conduit for information, and established control of the narrative emerging from Michael Brown's death. In Boston and Keene, social media played a role before unrest unfolded, unlike in Ferguson, where its influence was seen subsequent to the start of events. Social media initially served as an attractor in Boston and Keene, providing a stimulus around which events occurred.

5. Metis

Through metis, the crowds in Ferguson, Boston, and Keene adapted behaviors intended to extend the life of their groups. Learning to adapt was a result of interactions with environmental elements, such as the police. The Ferguson crowds learned how police would respond to challenges from the crowd, and adapted their tactics accordingly, such as when looters, emboldened by a lack of police response to thievery, expanded their number of targets.

Through interactions with the police, crowds in Boston and Keene soon learned that when law enforcement approached, someone was likely going to be arrested. This resulted in the adaptive behavior of fleeing, or of throwing rocks and bottles at police to avoid arrest.

Moving *en masse* was the most obvious adaptive crowd behavior. Much like the schools of fish studied by Sagarin, humans in crowds found safety in numbers, and adapted their behavior when facing a perceived threat, such as the police.

6. A Word about Social Media

The burgeoning role of social media is a significant development in crowd system dynamics. Social media's capacity for instant communications facilitates self-organization in a crowd by acting as a conduit through which information can be passed, and nascent linear interactions formed. Social media can also facilitate emergent crowd behaviors by providing direction to elements within the crowd. Finally, it can be argued

that social media facilitates metis by providing a medium through which large numbers of people can obtain information.

This author believes social media can affect multiple characteristics of crowds viewed through a complex adaptive systems framework. Whether facilitating self-organization, emergence, or metis, social media can have a significant impact on crowd systems dynamics, making crowds more adept at hindering law enforcement efforts at control.

V. STRATEGIC IMPLICATIONS FOR POLICE

Situations involving unruly crowds present significant challenges to law enforcement agencies. Crowds that occur spontaneously, as in the case studies presented in this work, are especially challenging because they often catch law enforcement by surprise. The sudden emergence of an unruly crowd challenges individual officers physically and mentally, and exposes weaknesses in a police agency's policies, training, and equipment.

Policy provides guidelines for responding to crowd control situations. Policies are the bedrock upon which training and equipping for crowd control events should be based. The manner in which crowds adapt to environmental stimuli, including police efforts at controlling them, can be directly impacted by police policies. For instance, a policy favoring a heavy-handed approach may prove inadequate if a more measured approach would have more appropriately preserved order. It makes no sense facing down a peaceful demonstration with officers dressed in protective riot gear, brandishing 36-inch riot batons, when police officials in standard uniforms exercising restraint would be sufficient. A lack of policy guiding police action in crowd control operations leaves responders to make up responses contemporaneous with events, opening the possibility of improper police action resulting in injury, property damage, and litigation.

The three case studies in this work feature crowds with differing antecedents for their formation. The Michael Brown shooting, and the minority community's simmering frustrations over perceived injustices at the hands of the police and court system, provided the catalyst for unrest in Ferguson. The crowd that converged on Boylston Street in Boston was celebrating the end of an eighty-six year drought of World Series championships by the Red Sox. The Keene Pumpkin Festival unrest resulted from crowds lacking any particular purpose or focus. It was social media invitations to parties providing the draw for Keene.[245] Each of the case studies saw crowds adapt to stimuli in the environment, challenging the policies of responding police agencies.

[245] "The Anticipation Is Real," FinnaRageTV, October 16, 2014, http://finnaragetv.com/post/100168486002/the-anticipation-is-real-keene-state-see-you.

A. POLICY IMPLICATIONS

Police policy is often inadequate for handling emergent crowd control events due to its rigidity, unrealistic assumptions, ineffective training mandates, and outdated thinking. The police are a paramilitary entity characterized by rank structure, uniforms, weaponry, and policies governing personnel actions. The police are subject to strict domestic rules and laws governing their actions, leading to rigid policies meant to ensure conformance with those mandates. These rigid policy mandates stymie the flexibility necessary to adapt to rapid situational evolutions in crowd control situations. For instance, policies mandating supervisory approval of every move to counter crowd actions introduce delays in response to crowd behaviors. Time delays in the feedback loop between supervisors and front-line personnel mean decisions may already be obsolete. Such delays mean the police are destined to continuously play catch-up.

In developing policy, police agencies can fall prey to making unrealistic assumptions. Policy-makers may fail to recognize that policy cannot account for all the variables in crowd control. In the author's experience, every interaction with the public is unique, as routine or complex as it may seem. The Boston Police Department recognizes the uniqueness of crowd interactions by separating crowds into three categories, "organized marches and demonstrations, peaceful disobedience, and non-peaceful civil disobedience."[246] Each category possesses its own idiosyncratic character, which influences police response in crowd control. It is unrealistic to assume rigid policy, based on past practices, can account for all the behavioral characteristics of a crowd. In crowd control, for example, a policy based on an assumption that a crowd will remain static lacks the flexibility needed to respond to emergent crowd behavior, such as spontaneous mass movement, or a turn to violence.

A further assumption in policy development is that upper-level management does not require crowd control training. This author's agency is an example of this assumption. Crowd control training is mandated for all officers up to the rank of captain, not by policy, but by order. Above the rank of captain, there is no mandated crowd

246 "Rules and Procedures: Rule 200: Critical Incident Management," Boston Police Department, August 16, 2002, sec. 1 A–C, http://bpdnews.com/rules-and-procedures/.

control training. It is assumed upper management will know the strategic and operational intricacies of crowd control, but this is not necessarily the case. While some upper-level management will avail themselves of the training, most do not, leaving them to guess or draw from outdated experiences for direction.

Ineffective or improper training due to flawed policies is another problem plaguing police agencies. Flawed policy creates increased potential for civil litigation under 42 U.S. Code § 1983, whereby an aggrieved party may seek legal redress for harms resulting from a deprivation of rights by police performing their official duties.[247] Deprivation of rights may result when policy is so vague or lacking that it causes officials to act outside the bounds of reasonableness or the law.

This issue of training is so crucial that it was taken up by the United States Supreme Court. In *City of Canton Ohio v. Harris,* 489 U.S. Code 378 (1989), the court upheld a lower court decision that a municipality failing to train employees could be liable under § 1983 for constitutional violations.[248] The Supreme Court further held that "the inadequacy of police training may serve as the basis for § 1983 liability, only where the failure to train in a relevant respect amounts to deliberate indifference to the constitutional rights of persons with whom the police come into contact."[249] In *Monel v. City of New York Department of Social Services*, 436 U.S. Code 658, the Supreme Court determined, when failing to train reflects a "deliberate" or "conscious" choice by the municipal entity, that failure can be considered an actionable city "policy."[250] The court also ruled in *Monel*, "It is only when the 'execution of the government's policy or custom…inflicts the injury' that the municipality may be held liable under § 1983."[251] These court decisions are a direct result of flawed policy, where a failure to train amounted to deliberate indifference on the part of police officials.[252] A lack of adequate

[247] "42 U.S.C. § 1983—Civil Action for Deprivation of Rights," Legal Information Institute, accessed November 28, 2015, https://www.law.cornell.edu/uscode/text/42/1983.

[248] City of Canton, Ohio v. Harris 489 U.S. 378 (1989)

[249] Ibid.

[250] Ibid.

[251] Ibid.

[252] Ibid.

police training policy stymies the flexibility necessary to adapt to rapid changes in crowd control situations, potentially exposing law enforcement officials to § 1983 violations and subsequent litigation.

A final issue regarding policy is outdated thinking based on past practices. Policy-makers who rely solely on past practices may find those practices ineffective in light of social and technological changes in society. Social injustice, political upheaval, and technology are among the issues around which crowds form.

Social injustice toward African-Americans has spawned the emergence of the Black Lives Matter movement. Police policy makers who fail to account for such concerns may find themselves adhering to outdated policies that fail to consider such matters. The shooting of Michael Brown in Ferguson provides an example of policy failing to recognize racial sensitivities in the crowd. When the Code 1000 was issued for mutual aid in Ferguson, some officers arrived and deployed police dogs against the largely African-American crowd. Use of police dogs was viewed by the crowd as a provocation, reminiscent of violent civil rights protests of the past, in which dogs were used aggressively against demonstrators. A failure of policy to control canine deployment in Ferguson provided a stimulus contributing to the emergent ire and self-organized criticality of the crowd.

Political upheavals on other parts of the globe also create potential crowd control situations here in America, as expatriates and immigrants from other lands demonstrate for or against issues in their former homelands. Social concerns surrounding the United States' involvement in the Middle East provides the impetus for current protests. This was recently evidenced in Boston, where hundreds of people rallied in support of allowing Syrian refugees to resettle in the city.[253] It would be impossible to draft police policies and procedures addressing every cause of social unrest. However, policies failing to at least generally acknowledge the idiosyncrasies present in those causes may inadvertently propagate unrest through perceived injustices or insensitivities.

[253] Christopher Gavin and Lauren Fox, "Hundreds Rally against Baker's Stand on Syrian Refugees," *Boston Globe*, November 21, 2015, https://www.bostonglobe.com/.

Failure to consider the importance of social media to protest movements is another demonstration of outdated thinking. Adaptations in crowd behavior are easily facilitated by social media. Text messaging and use of sites such as Twitter and Facebook make instant communications possible, allowing crowds to adapt at a moment's notice to stimuli presented by the police. Perhaps the greatest advantage of social media, however, is its ability to quickly espouse the view of crowds and control the emerging narrative. Images can be captured by camera-phone and instantly distributed globally to gain support for a cause. Such control enables a crowd to maintain adherents to the cause while recruiting others sympathetic to the movement. Police agencies that fail to enact policies taking advantage of social media risk losing control of the narrative. A federal probe into the Ferguson riots determined protesters controlled the rapidly evolving narrative from the outset. The police, on the other hand, practiced a slow, measured release of information, failing to wrest control of a narrative from protesters. Controlling the narrative is crucial to police efforts at gaining public support for their efforts in crowd control situations.

B. TRAINING IMPLICATIONS

Training facilitates the operational capability of law enforcement and is critical to the strategic aims of prevention, mitigation, and recovery from unruly crowd events. Training curricula espousing a monolithic view of crowds, with a one-size-fits-all approach to handling them, fails to prepare police officers to manage emergent crowd behavior. For instance, curricula that views an orderly crowd of over-anxious shoppers waiting for a store to open on Black Friday the same as a violent, drunken, college crowd fails to recognize perceptible differences that need to govern the way police react. One may merely require the calming presence of a friendly, uniformed police officer, while the other may require a more forceful approach. Espousing the same manner of training for each type of crowd makes no more sense than a running coach advocating the same training regimen for sprinters and marathoners.

Adaptability of crowds is a major consideration when creating training curricula addressing crowd behavior. Flexibility is the key for law enforcement. But the rigid,

paramilitary command structure of most police departments places too much emphasis on inflexible, centralized decision-making. Sagarin observes that allowing "localized agents" to sense changes in the environment, and then letting them adapt to those changes, is superior to a strict adherence to centralized control.[254] Centralized control fails to sense situational changes quickly enough to stay ahead of events in chaotic, rapidly evolving crowd control situations. Sagarin further posits two reasons why decentralized control is more adaptable to environmental changes than centralized control. First, decentralized control provides multiple sensors that detect changes and opportunities in the environment. Those sensors are more attuned to happenings in their presence than a centralized command node cloistered in an off-site command center. Secondly, environmental sensors are quicker to respond to environmental changes.[255] With proper officer training, decentralized police crowd control operations can respond more rapidly and independently to environmental change while still working within parameters established by the incident commander. Police commanders will find it difficult to seize the initiative without the ability to rapidly sense and respond to environmental changes.

Finally, the Supreme Court case of *City of Canton, Ohio v. Harris* made it clear that an agency may be held liable under 42 U.S. Code § 1983 for *deliberate indifference* if a failure to adequately train law enforcement leads to constitutional rights violations.[256] When considering the multiple disciplines and policy issues involved in controlling unruly crowds—use of force, arrest procedures, command and control, de-escalation techniques, and more—it is evident that crowd control operations provide fertile ground for potential § 1983 litigation when adequate training policies are lacking.

C. EQUIPMENT IMPLICATIONS

Properly equipping police officers to handle crowd adaptability is another important strategic consideration for law enforcement. The police have a greater choice of tools available for crowd control than ever before. The vast array of equipment ranges

[254] Sagarin, *Learning from the Octopus*, 64.

[255] Ibid., 67.

[256] Karen Michele Blum and Kathryn R. Urbonya, *Section 1983 Litigation* (Washington, DC: Federal Judicial Center, 1998), 59.

from the basic gear an officer carries on his or her duty belt, to highly specialized gear such as protective clothing, hand-held shields, large-capacity riot control agent dispensers, non-lethal impact tools, armored vehicles, helicopters, and more.

A crucial decision for policy makers and commanders in the field is what tools to use in a crowd control situation. Utilizing the wrong tools, at the wrong time, on the wrong crowd, can create undesirable consequences for police. For instance, the use of certain non-lethal control devices may be context sensitive, where their use generates unintended political fallout.[257] Researchers at Penn State University have observed the use of certain crowd control devices may be acceptable in one context, but politically unsavory in another. They proffer the example of using riot batons as acceptable to control soccer hooligans in Europe, while baton use against striking workers or welfare mothers would provoke public outcry.[258] The Penn State findings comport with a study by the Police Executive Research Forum that found proper use of less-lethal control tools was generally supported by society, while improper use of such tools often resulted in harsh public rebuke of police.[259] Therefore, it is critical police commanders consider political and cultural sensitivities within their communities and the crowds they deal with before authorizing the use of specialized crowd control tools.

Police would be well served to have an array of specialized tools available to meet the challenges posed by crowd adaptations. The minimum level of police equipment for a crowd posing few issues is that of a well-trained, uniformed officer with basic duty belt gear: a firearm, chemical irritant spray, handcuffs, baton, and radio. Such equipment is adequate to handle most crowd control situations short of the unrest that plagued Ferguson and Keene.

When a crowd has achieved a state of self-organized criticality, law enforcement would be better equipped for potential unrest with higher-level tools, such as specially

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[257] John M. Kenny et al., *Crowd Behavior, Crowd Control, and the Use of Non-Lethal Weapons* (State College: Pennsylvania State University, 2001), 31, http://oai.dtic.mil/oai/oai?verb=getRecord&metadataPrefix=html&identifier=ADA446472.

[258] Kenny et al., *Crowd Behavior*.

[259] Narr et al., *Police Management*, 59.

trained officers clad in protective riot gear, non-lethal impact devices, large-capacity chemical irritant dispersal devices, armored vehicles, canines, and other tools deemed appropriate by incident commanders. Police would then have the proper tools available to contain or disperse a crowd if the crowd suddenly displayed emergent violence. The presence of weapons in a crowd is a reliable predictor of pending violence, necessitating the presence of specially trained personnel and tools to alleviate the threat.[260] However, not until a crowd displays violent tendencies would it be prudent to use higher-level control equipment on a crowd. Use of such tools may create undue tension and violence in a crowd on the cusp of self-organized criticality.

[260] Bliss et al., "Crowd Reactions to Sublethal Weapons," 2545.

VI. RECOMMENDATIONS

Police are not accustomed to viewing crowds holistically, as complex adaptive systems. Taking a holistic view of crowds provides insights not readily apparent when viewing crowds as aggregations of individuals, whose behaviors can be explained by traditional psycho-social theories. Learning to view crowds as complex adaptive systems provides a different perspective on the inner machinations of a crowd, and helps explain their self-organization and emergent behaviors. This view also reveals implications for strategic decision makers in the areas of policy, training, and equipping for crowd control operations. Recommendations in this chapter address those implications.

A. POLICY RECOMMENDATIONS

Most police departments in the United States give at least some acknowledgement to crowd control in their internal policies. Those that are accredited by The Commission on Accreditation for Law Enforcement Agencies (CALEA), a private entity setting and ensuring compliance with professional standards, are required to have policies regarding crowd control, which CALEA considers a critical task.[261] Non-accredited agencies are under no obligation to have policies in place addressing crowd control. Police agencies without such policies run the risk of culpability in litigation resulting from inappropriate responses to unruly crowds. Therefore, this thesis recommends that law enforcement agencies without crowd control policies create such policies.

Policies mandating rigid centralized control of police assets lack the flexibility to quickly respond to emergent behaviors in dynamic crowds. Therefore, policy must incorporate decentralized decision making on the part of well-trained supervisors acting within parameters established through that policy. Supervisors can then respond immediately, without waiting for direction from centralized command, by sensing emergent behaviors in the crowd. As long as supervisors act in a manner consistent with incident commanders' objectives, supervisors will further the tactical and strategic

[261] "Critical Tasks as Identified by CALEA," CALEA, May 14, 2008, sec. Field Activities: Crowd Control Procedures and Techniques, http://www.calea.org/content/critical-tasks-identified-calea.

objectives at hand. These supervisory actions must be reported to incident commanders simultaneous to their implementation, or as soon as practicable, to ensure accurate situational awareness.

It is further recommended that police crowd control policies not fall prey to unrealistic assumptions and outdated thinking. One such assumption is that a one-size-fits-all approach to crowd control is always appropriate. For instance, a policy mandating tactical protective gear, instead of standard duty uniforms, for every crowd fails to provide a measured response proportionate to most threats. The one-size-fits-all way of thinking may have been acceptable in the 1960s and 1970s, when escalated force models and repression of protesters were the norm.[262] Today, such an approach may be quite suitable for a crowd displaying violent propensities, such as in Ferguson, but an overreaction to a peaceful demonstration may provide the stimulus for the emergence of more aggressive behavior on the part of the crowd. This is an observation not lost on Captain Dennis Kato of the Metro Division of the Los Angeles Police Department, who said, "We put a lot of uniformed presence out there, a lot of conversation, a lot of talking-to prior to, and yet we have those [officers in tactical clothing] placed in situations and hidden from view, to deploy as necessary."[263] Kato realizes it may be necessary to employ specially trained officers and equipment in a crowd control event, while also recognizing specialized assets may not be the first wise choice for controlling a crowd.

The Boston Police Department has adopted crowd control policies that recognize a one-size-fits-all approach lacks flexibility. Their policies recognize officers need guidance in the exercise of discretion instead of demanding singular action in every event. Boston's policies also recognize the value of dialogue as a primary tactical option in crowd control.[264] Establishing compliance through dialogue, not arrest, is the Boston Police Department's preferred means of restoring order, even in the face of illegal

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[262] Patrick F. Gillham, "Securitizing America: Strategic Incapacitation and the Policing of Protest since the 11 September 2001 Terrorist Attacks," *Sociology Compass* 5, no. 7 (July 2011): 636, doi: 10.1111/j.1751-9020.2011.00394.x.

[263] Sara Schreiber, "Tools of the Riot Control Trade," *Law Enforcement Technology* 36, no. 9 (September 2009): 79.

[264] Masterson, "Crowd Management," 4.

activity.[265] Arrests shall be the next option if dialogue fails to gain compliance and restore order.[266] Giving officers these kinds of choices in a crowd control situation allows them the flexibility needed handle emergent crowd behavior.

A further example of an unrealistic policy assumption is found in the treatment of riot control agents, such as tear gas, used to disperse unruly crowds. Many agencies maintain strict controls on the use of such equipment, requiring them to be stored in a central location and utilized only after cumbersome chain-of-command protocols are followed. Such control introduces delays in the deployment of these agents. Police use of chemical dispersants in crowd control is a significant increase in the use of force. Such an increase should only be at the behest of incident commanders through a streamlined authorization process. Storing chemical dispersants in a central repository, instead of at the scene of a disturbance, introduces unnecessary delays in their use, invalidating any assumption they would be immediately available to officers if needed. Chemical dispersants are best carried on-scene by qualified officers, and only used upon proper authority.

Another significant policy assumption among some police agencies is that upper-echelon commanders will be knowledgeable in crowd control operations without the virtue of command-level training. This author realizes previous experience in crowd control has merit. However, reliance on paradigms of the past as hard-and-fast templates on handling crowds potentially relegates such operations to failure. Past paradigms of crowd control may not account for recent emergent behaviors by crowds. Case in point: the advent of social media has significantly changed crowd dynamics, making crowds more informed and agile. Social media has advantages for the police as well, allowing them to communicate with the crowd through electronic messages, or track a crowd's intentions via monitoring its communications. Commanders failing to consider the use of social media are operating on outdated assumptions and functioning at a disadvantage.

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[265] "Boston Police Department Rules and Procedures: Code 100."

[266] Ibid.

The assumption that commanders know how to command large-scale movements of officers by virtue of rank alone is foolhardy. In the para-military structure of law enforcement, obedience to directives of commanders is called for. However, rank does not magically imbue one with the knowledge to command officers at an unruly crowd control event. Such an event involves a great many variables, and requires command skills only derived from experience and training. In crowd control, incident commanders must deal with a myriad of issues, such as movement and placement of officers, communications and interoperability difficulties, personnel problems (such as untrained or ill-equipped officers), missing or defective equipment, traffic flows, media releases, medical emergencies, crowd behaviors, legal and civil rights issues, and many more variables. Rank alone does not qualify commanders to handle all these variables and synthesize them into a proper response. It is recommended that policy mandates the training of command-level personnel up to and including the agency head. This thesis further recommends police policy institutes mandatory crowd control training for field supervisors and line officers, since these will be the officers responsible for implementing the commander's plan for achieving strategic goals in crowd control events. Policies that fail to mandate supervisory and line-level training place an unrealistic burden on officers tasked with coordinating responses to emergent crowd adaptations.

The final policy recommendation in this work is to create the position of strategic/ tactical social media officer. This officer will monitor social media and analyze social media postings to provide incident commanders with real-time, actionable intelligence in crowd control situations.

B. TRAINING RECOMMENDATIONS

For the police, training is a vital preparatory component in responding to crowd control incidents. The ramifications of failing to train officers have been established by the United States Supreme Court. It bears repeating that the courts have adopted the concept of deliberate indifference on the part of police agencies and individuals they employ. Deliberate indifference recognizes an agency's failure to adequately train officers as a deliberate lack of concern or importance for training. Therefore, all officers

potentially involved in crowd control must be trained. The United States Department of Homeland Security recommends that training for civil disorders be held annually. The department also recommends specialty and primary response teams train at least quarterly.[267] This author concurs with those recommendations, and further recommends police agencies adopt the training paradigm of the British College of Policing, in which officers are not only trained, but certified annually through rigorous written and practical testing in riot control.[268]

This work recommends all police officers be trained to view crowds as complex adaptive systems, so they understand that a stimulus introduced to one part of a system creates resultant actions in another. This, in turn, can lead to Per Bak's avalanche concept and a disruption in system equilibrium, leading to dramatic, system-wide change. To illustrate the point, consider a crowd teetering on the edge of self-organized criticality. If a commander orders an unannounced advance of baton-wielding officers in riot gear, it would have a localized effect on the crowd, likely leading to violence. That same action could possibly reverberate throughout the whole crowd, leading to widespread unrest. Whether a stimulus produces a turn away from unrest or precipitates violence depends upon the decisions made by everyone from incident commanders to officers on the line. The more officers know about how systems work and adapt, the better prepared they will be to address crowd control issues from a system-wide perspective.

Sagarin recognizes that the strength of any species is its capacity to ensure its continued existence through adaptation.[269] The same may be said about self-organized crowds, which ensure their viability by adapting to environmental stimuli. Such was the case with the crowds in Ferguson, where they erected barricades in the streets, threw Molotov cocktails, engaged in swarm behaviors, and leveraged technology to thwart police efforts to disperse them. Police officers must be trained to recognize crowds are unlikely to stand idly by while police challenge their viability. Crowds will adapt, and

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[267] Center for Domestic Preparedness, "Managing Civil Actions," PTI–28.

[268] "Command," College of Policing, accessed August 7, 2015, sec. Accreditation of Commanders, https://www.app.college.police.uk/app-content/public-order/command/.

[269] Sagarin, *Learning from the Octopus,* 120.

law enforcement must be trained to be flexible enough in its response to adapt to meet emergent challenges.

The Toronto Police Service recognizes that "flexibility is the key to meeting the demands presented by a dynamic crowd."[270] One way to ensure flexibility is to train officers for decentralized operations. This is not to say incident commanders and other command staff personnel should not exercise command and control over things of strategic importance. Strategic imperatives must remain the purview of command personnel. However, command personnel must not become bogged down in tactical decisions best left to field supervisors. Field supervisors must be trained to sense the various stages of the crowd as a system, and base tactical decisions upon that sensing. Relying on a single central node of command, which does not sense the immediate tactical environment, does not lend itself to rapid, decisive decision-making. Sagarin recognized, "The most successful biological organisms have an organization that eschews centralized control in favor of allowing multiple agents to independently sense and quickly respond to environmental change."[271] This same concept can apply to crowds and those tasked with controlling them. Police officers engaged in crowd control must be trained to recognize changes in the environment and be problem solvers, applying appropriate solutions to emergent conditions.

A case illustrating the need for decentralized control was the deployment of the Massachusetts State Police during a Black Lives Matter protest on Nashua Street in Boston in December 2014.[272] During that event, front-line officers received mixed signals from both command-level personnel and field supervisors. Some officers were ordered to brandish riot batons while others were not. Some were directed to use protective face shields while others were not. Although the Nashua Street deployment

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[270] Toronto Police, *Toronto Police Service Public Order Student Manual*, 27.

[271] Rafe Sagarin, "Decentralized," Adaptable Solutions, accessed December 13, 2015, http://adaptablesolutions.org/.

[272] Kim Tunnicliffe, "Police Make Arrests during Boston Protest," CBS Boston, December 13, 2014, https://embed.radio.com/clip/58699957/?ref_url=http%3A%2F%2Fboston.cbslocal.com%2F2014%2F12%2F13%2Flarge-protest-expected-saturday-on-boston-common%2F&station_id=481&rollup_ga_id=UA-2438645-53&ads_ga_page_tracker=UA-17434257-42.

was ultimately successful at preventing widespread unrest, conflicting orders engendered loss of continuity in the chain of command. These issues would not have occurred had command personnel not become embroiled in tactical decisions best left to front-line supervisors.

In the paramilitary organizational structure of the police, one could reasonably ask why decentralized control should be used in crowd control operations. Remembering incident commanders will maintain strategic control, we turn to Sagarin's observation that "adaptable organizations combine the resources, goals and power of a centralized controller with nimble and adaptive actions of multiple semi-independent sensors."[273] Sagarin goes on to point out the success of such systems, which have evolved over millions of years in the biological world.[274] A decentralized command paradigm would work by ensuring flexibility in response through multiple, independent, sensing nodes with the authority to make decisions in the tactical sphere. To establish such a paradigm, it is recommenced that a flexible and rapidly adaptable response capacity is ensured by training officers at each level of command commensurate with their responsibilities. In this decentralized paradigm, a central authority is still useful in defining the greater strategic vision and obtaining resources to fulfill that vision, while line officers and supervisors are free to make decisions within the bounds of policy and parameters established by the incident commander.[275]

Police officers must be trained to realize some crowds train to prepare for civil unrest. There are a number of training resources available to demonstrators teaching the use of tactics and specialized equipment in the pursuit of civil disobedience. Online resources provide guides for tactical movements and use of specialized tools to defeat police methods of control. One such resource is "Bodyhammer: Tactics and Self-Defense for the Modern Protester." It provides advice on mass movements of people and the use of tools such as physical barriers and protective clothing to thwart police. Particularly telling is Bodyhammer's contention that "the police are much easier to predict than most

[273] Sagarin, *Learning from the Octopus*, 80.

[274] Ibid.

[275] Sagarin, "Decentralized."

people fear."[276] The authors of this online guide know most law enforcement are subject to strict lines of authority, making police formation movements cumbersome and predictable. Therefore, Bodyhammer features tools and tactics that are adaptable, providing flexibility when dealing with police efforts at controlling crowds. Similarly, "Know Your Enemy: The Riot Cop" is the subtitle of a chapter on riot training found in "Warrior Crowd Control and Riot Manual," another online guide featuring offensive tactics to use against the police.[277] This manual contains recommendations for the use of Molotov cocktails, lighted flares, and other dangerous projectiles against the police.[278]

Other resources provide live training for organized demonstrators in addition to online and written training material. The Ruckus Society provides in-person training in civil disobedience for demonstrators.[279] According to its mission statement, "The Ruckus Society provides environmental, human rights, and social justice organizers with the tools, training, and support needed to achieve their goals through the strategic use of creative, nonviolent direct action."[280]

A crowd prepared for defeating police efforts at control can be problematic for law enforcement agencies that have failed to train for such possibilities. Therefore, training officers to control such crowds is essential. Officers must be prepared mentally, and with the proper tools, to handle crowds that have trained for encounters with the police, even though it is unlikely crowds in the throes of chaotic interactions would use organized tactics *en masse*. However, such tactics may still be encountered by police in self-organized pockets among the crowd.

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[276] Sarin, "Bodyhammer."

[277] "Warrior Crowd Control," Warrior Publications, 12.

[278] Ibid., 20.

[279] See www.Ruckus.org.

[280] "Mission & History," The Ruckus Society, December 20, 2015, http://ruckus.org/about-us/mission-history/.

C. EQUIPMENT RECOMMENDATIONS

Equipment issues are of vital concern to police engaged in controlling unruly crowds. Ensuring deployment and proper use of specialized equipment can have a leveraging effect in both force protection and offensive operations by creating force multipliers for the police. An example is the intimidation factor of relatively few officers dressed in hard-shell protective riot gear, euphemistically known as *turtle suits*. According to Kato, the Los Angeles Police Department recognized the force multiplier effect of such gear by stating, "It's very intimidating when you see that."[281] Therefore, it is recommended that police agencies recognize and take advantage of the force multiplier effects of specialized crowd control tools.

Law enforcement officials must be aware that deployment of specialized gear can have a paradoxical effect, where its presence creates more emergent, disruptive behaviors than it stops. Boston Police Commissioner William Evans recognized this when he posited that if you come looking like you want to fight, you will indeed have a fight on your hands.[282] The Toronto Police Service recognizes this fact and equips officers accordingly. Toronto sees the value in a "professional and pro-active approach," as opposed to confronting the public with riot gear.[283] Toronto has recognized an alternative to visible riot protective clothing in their "soft-tac" uniform, which conceals protective pads under a non-threatening uniform.[284] Their "hard-tac" uniform, on which protective equipment is displayed in plain view, is for situations that have devolved into violent confrontation.[285] This hard-tac approach features officers wearing helmets with face shields and carrying specialized gear, such as Plexiglas shields and extra-long batons. In this author's experience, being dressed in hard-tac and carrying specialized crowd control

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[281] Schreiber, "Tools of the Riot Control Trade," 79.

[282] Will Roseliep, "Boston Police Commissioner William Evans on the Need for Mutual Respect," WGBH News, January 13, 2015, http://wgbhnews.org/post/boston-police-commissioner-william-evans-need-mutual-respect.

[283] Toronto Police, *Toronto Police Service Public Order Student Manual*, 4.

[284] Ibid., 25.

[285] Ibid., 26.

gear requires a great deal of training to be used properly. This work recommends agencies equipped with such gear train and certify their officers annually in its use.

Specialized riot control gear used by the police goes well beyond the aforementioned hard and soft-tac uniforms. Chemical dispersants, such as tear gas and impact devices delivering small bean-bags or other blunt force objects from stand-off distances, are among the tools available to control or disperse unruly crowds. Specialized armored vehicles and high-tech devices such as the long-range acoustic device, which emits high-frequency, ear-piercing tones to disperse a crowd or deliver orders, are now being deployed by police agencies across the nation. Officers must recognize the various stages of a complex adaptive system as applied to a crowd when considering the use of specialized equipment. It is recommended any specialized equipment be used judiciously, and only at appropriate stages of the crowd system, so as not to provide a stimulus leading to unrest in the crowd.

The level of training needed to employ highly specialized equipment often exceeds the capabilities of police departments, forcing them to seek instruction from equipment manufacturers or vendors. This thesis recommends training regimens of these outside entities be vetted to ensure they comport with current legal and ethical standards of use. Vetting will ensure the proper deployment and use of specialized gear to prevent litigation resulting from its use.

It is false to assume the police are the only ones bringing specialized tools to a crowd control event. Elements of unruly crowds often employ specialized equipment of their own, including cobblestones dislodged from streets and hurled at police, as seen in the 2015 riots in Baltimore. Some crowds make use of homemade shields and body armor, espoused in the "Bodyhammer" manual.[286] Protesters at the G-20 summit in

[286] Sarin, "Bodyhammer." This on-line manual features specialized tools and tactics protesters can employ against the police. Though the manual is of dubious origin, its tools and tactics have been seen by police.

Pittsburgh improvised and adapted their behavior to roll trash dumpsters downhill at police lines.[287]

The police must be equipped and trained in how to defeat specialized tools used by crowds. *Sleeping dragons* are one such tool popular among some protest groups.[288] This author has witnessed first-hand the use of sleeping dragons to block traffic on busy interstates, as was done in Milton and Medford, Massachusetts in January of 2015.[289] Sleeping dragons and other protester devices can be problematic for police agencies not trained or equipped to defeat them. Specialized teams of officers whose responsibilities include dismantling protester devices such as sleeping dragons must be trained and equipped with appropriate hand and power tools needed for that highly specialized task.

Social media is perhaps the most ubiquitous tool that has emerged in crowds today. Cell phones and computers have become indispensable tools in distributing messages among crowds and documenting police actions. As seen in the case studies, these devices played a significant role in coalescing disparate elements of the crowd by facilitating the change from chaotic, nonlinear interaction to self-organization capable of emergent behaviors. Indeed, modern-day protesters have taken to heart what Sagarin realizes when he suggests decentralized organizations shine when pitted against centrally controlled entities, such as the police.[290] Social media enables crowds to do just that—they are able to quickly self-organize from chaotic masses into decentralized entities. The police are left to deal with often unpredictable behaviors that emerge at the whim of self-organization lacking centralized control. This is why law enforcement must be flexible in its response to crowds, and not controlled by strict lines of reporting and direction.

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[287] "Pittsburg G20 Protestors Use Dumpsters Bricks Police Use Sound Weapons Tear Gas," YouTube video, posted by "safenders," September 24, 2009, 4:05, https://www.youtube.com/watch?v=WyQBqOxgNN8.

[288] Sleeping dragons is the name colloquially given to devices usually consisting of a PVC or metal tube into which protesters insert their arms and lock themselves together, or to objects.

[289] Peter Schworm et al., "Protesters Snarl Morning Commute on I-93 near Boston," *Boston Globe*, January 15, 2015, https://www.bostonglobe.com/metro/2015/01/15/protesters-block-traffic-southeast-express-northbound/G3aLvpDWRixI2I6SVyaErM/story.html.

[290] Sagarin, *Learning from the Octopus,* 74.

One way for law enforcement to remain flexible is to adopt the use of social media. This networked technology can provide valuable information about social networks, which can then be exploited to assist in operational decision-making.[291] Research at the Common Operational Research Environment lab at the Naval Postgraduate School has proven social network analysis can supplement other information sources to provide *geospacial*, *relational*, *temporal*, and *sentiment* information. Geospacial analysis is used to find the location of the social media users through their device's global positioning system features, or through published information contained in their postings.[292] Relational analysis provides data as to who is communicating with whom. This is useful to determine who is spreading information or dictating crowd movements. A "variable of interest," which can be measured over a period of time, is subject to temporal analysis.[293] Temporal analysis provides data about certain events or trending information. Finally, sentiment analysis provides for "the automatic extraction of feelings, likes and dislikes, or opinions from text."[294] Sentiment analysis provides a way to gauge the overall sentiments of a crowd by analyzing what is written in online postings.

Social network analysis provides data that officials can use to determine in what stage of a complex adaptive system a crowd lays. Using social network analysis requires specialized training. Choosing to ignore the advantages of social network analysis because of this requirement is imprudent. It is essential for successful crowd control operations today to leverage the power of social network analysis. To that end, it is recommended law enforcement agencies equip a strategic/tactical social media officer with the technology needed to provide real-time, actionable intelligence to the incident commander contemporaneous with events.

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[291] Gregory Freeman and Robert Schroeder, *Social Media Exploitation: An Assessment* (Monterey, CA: Naval Postgraduate School, 2014), 6.

[292] Freeman and Schroeder, *Social Media Exploitation*, 51.

[293] Ibid., 54.

[294] Steve Shellman, Michael Covington, and Marcia Zangrilli, "Sentiment & Discourse Analysis:Theory, Extraction and Application," in *Socio-Cultural Analysis with the RSI Paradigm*, ed. Charles Ehlschlaeger, 66–82 (Boston: SMA Publicadtions, 2014), 66, doi: 10.13140/2.1.3449.0241.

VII. CONCLUSIONS

Much recent attention has focused on the manner in which law enforcement responds to unruly crowd events. Police tactics have garnered increased scrutiny as claims of civil rights abuses have led to civil and criminal actions against law enforcement agencies and individual officers. The increased attention has caused police administrators, the courts, and society to review and rethink issues surrounding the way police handle crowd control situations. The manner in which police view a crowd is one such issue, especially as it relates to crowd adaptability and subsequent impacts on police policy, training, and equipment.

One focus of this thesis has been the systems framework used to explain crowd adaptations during encounters with law enforcement. That same framework was employed by Gel-Mann and Bak to pioneer new insights into the physical world of systems and their behaviors. Further work by researchers such as Eidelson and Agar showed the efficacy of employing a systems approach to viewing crowds. This thesis has taken that approach and applied it specifically to unruly crowd encounters involving the police. In doing so, the systems framework has provided an understanding by which better-informed resource deployment decisions can be made.

It was not the intention of this work to provide a tactical "how-to" guide to crowd control, nor to disprove the usefulness of psycho-social explanations of crowd behavior. Rather, it was to provide an alternative manner by which to view crowds and understand what causes their emergent behavior, and the impact of that behavior on police policy, training, and equipment decisions.

Through selected case studies, it was shown crowds can be viewed as complex adaptive systems, made up of numerous heterogeneous elements displaying chaotic, nonlinear interactions eventually leading to self-organization. Once self-organization is achieved, stimuli in the environment can lead to self-organized criticality, a condition in which even a minor stimulus can cause a catastrophic avalanche of unrest. From there, adaptive behaviors are learned through metis. Crowds that qualify as a complex adaptive

system teeter on the cusp of volatility. The manner in which police view and handle such volatile crowds is critically important to the outcome of crowd control operations. The importance of this thesis lies in providing law enforcement officials with an alternative manner in which to view crowds in order to better prepare for emergent crowd behaviors through informed policy, training, and equipment decisions.

Finally, the strategic implications to the police resulting from responses to emergent crowd behaviors were examined. Policy, training, and equipment were examined in light of the situational circumstances, and then recommending actions to give police strategic and tactical advantage in crowd control situations.

In the realm of policy, five recommendations were provided: First, law enforcement agencies without crowd control policies must adopt such polices. Next, policy must incorporate decentralized decision making on the part of well-trained supervisors acting within parameters established by the operational plan, policy, and law. Third, police crowd control policies must not fall prey to unrealistic assumptions and outdated thinking. Fourth, training and recertification in crowd control theory and tactics must be mandated for all officers potentially involved in crowd control operations. Lastly, the position of strategic/tactical social media officer must be created to analyze data from social media sources and compile it into actionable intelligence for incident commanders.

Regarding training, the first of six recommendations was crowd control training being held at least annually, while units with highly specialized roles, such as SWAT and mobile field forces train quarterly. This was in keeping with recommendations from the United States Department of Homeland Security. The next recommendation was that law enforcement should adopt the training paradigm of the British College of Policing, where all officers involved in crowd control certify annually through rigid written and practical testing. Third, all officers must be trained to view crowds as complex adaptive systems in order to understand how police actions in one part of the crowd may have systemic ramifications throughout the crowd. Fourth, law enforcement must be trained to be flexible enough in its crowd response to adapt to meet emergent challenges. Fifth, police officers must be trained to recognize changes in the environment and be problem solvers,

applying appropriate solutions to emergent conditions. Concluding the training recommendations, law enforcement must be trained in awareness of organized training resources available to crowds that provide guidance on defeating police tactics, and in awareness that crowds may employ these tactics against them.

The final area of recommendations was equipment. First, it is crucial that police agencies recognize and take advantage of the force multiplier effects of specialized crowd control tools, while also recognizing their use may heighten tensions. Next, police agencies employing specialized crowd control tools must annually train and certify officers assigned to use such equipment. Additionally, crowd control equipment should be used at appropriate times in order to achieve maximum effectiveness, and training regimens provided by vendors of specialized tools must be vetted to ensure compliance with current legal and ethical standards of use. The police must be trained and equipped with specialized tools in order to defeat specialized tools employed by protesters. Finally, police agencies should equip the position of strategic/tactical social media officer with the technology to provide real-time, actionable intelligence to incident commanders through the use of social media analytics.

A. RECOMMENDATIONS FOR FURTHER RESEARCH

The study of complex adaptive systems is relatively new in the field of science, especially as it applies to the study of human interactions. Its focused application in crowd control encounters with police is nascent and open to further research. Such research might include specifically how social and political contexts factor into how these systems act. For instance, is a crowd with a single overriding trait, such as race, more or less apt to display characteristics of complex adaptive systems? Are crowds with multiple political motivations, such as those that emerged from the Occupy Movement, more or less apt to exhibit qualities unique to complex adaptive systems? How can an ordered crowd system evolve into a complex adaptive system, or vice versa? These are among the many questions future research may endeavor to answer.

Also of interest for future researchers may be the synthesis of systems approaches with psycho-social approaches to explain crowd behavior. Combining the two may lead

to new and powerful discoveries in understanding crowd dynamics across a wide range of contexts.

The role of social media in the life of complex adaptive systems is another area of potential research. How the reach and celerity of social media influences crowd interactions from a systems perspective is open to exploration.

Finally, assessment of police adaptations to emergent behavior of unruly crowds is an area worthy of future research. As police adapt strategically and tactically, assessments of these adaptations must be examined to determine their usefulness from a systems perspective.

B. FINAL THOUGHTS

Moving forward, law enforcement in America must continue to ensure the rights of all Americans, particularly the right to free expression. Though dissent is essential to the functioning of a representative democracy, police, in their paramilitary culture, may see dissent as a threat to order. It should only be seen as such when it abrogates the rights of others and infringes upon liberties.

The means by which the police conduct their important responsibilities must ensure the rights of all are protected, including those participating in civil unrest. As society changes, so, too, do the expectations of its members. Society expects professional, impartial treatment by law enforcement. Therefore, it is incumbent upon the police to continually and critically reexamine their methods, and seek new and better ways of conducting their mission. By doing so they ensure the rights of all are preserved, and peace is perpetuated.

LIST OF REFERENCES

"30 Injured When Pumpkin Festival Turns to Mayhem." WCVB video. October 19, 2014. http://www.wcvb.com/news/30-injured-when-pumpkin-festival-turns-to-mayhem/29221310.

"1968 DNC: Democratic Nightmare in Chicago." YouTube video of Hubert Humphrey's nomination in 1968. Posted by "Passionate Patriots." September 29, 2008. https://www.youtube.com/watch?v=epxmX_58tOo.

Agar, Michael. "Complexity Theory: An Exploration and Overview Based on John Holland's Work." *Field Methods* 11, no. 2 (November 1, 1999): 99–120. doi: 10.1177/1525822X9901100201.

Allen, Jennifer M., and Rajeev Sawhney. *Administration and Management in Criminal Justice: A Service Quality Approach.* Thousand Oaks, CA: SAGE, 2009.

American Fact Finder. "Community Facts." Accessed October 9, 2015. http://factfinder.census.gov/faces/nav/jsf/pages/community_facts.xhtml.

Bak, Per. *How Nature Works: The Science of Self-Organized Criticality*. New York: Copernicus, 1996.

Bliss, James P., Corey Fallon, Nicole Headen, and Ryland C. Gaskins. "Crowd Reactions to Sublethal Weapons: Universal Triggers for Crowd Violence." *Proceedings of the Human Factors and Ergonomics Society Annual Meeting* 48, no. 22 (September 1, 2004): 2543–47. doi:10.1177/154193120404802207.

Blum, Karen Michele, and Kathryn R. Urbonya. *Section 1983 Litigation*. Washington, DC: Federal Judicial Center, 1998.

"Boston Celtics 2008 NBA World Champions." You Tube video. Posted by "Ryan Dowdy." June 18, 2008. 3:45, https://www.youtube.com/watch?v=EPztabtnjS4.

Boston Police Department. "Rules and Procedures: Rule 200: Critical Incident Management." August 16, 2002. http://bpdnews.com/rules-and-procedures/.

Bruce, Betsy. "Teenager Shot, Killed in Ferguson Apartment Complex." Fox. August 9, 2014. http://fox2now.com/2014/08/09/man-shot-killed-in-ferguson-apartment-complex/.

CALEA. "Critical Tasks as Identified by CALEA." May 14, 2008. http://www.calea.org/content/critical-tasks-identified-calea.

CBS News. “Ferguson Police Release Surveillance Video Related to Michael Brown Shooting.” August 15, 2014. http://www.cbsnews.com/videos/ferguson-police-release-surveillance-video-related-to-michael-brown-shooting/.

———. “Michael Brown Shooting: Vigil for Dead Teen Turns Violent.” August 11, 2014. http://www.cbsnews.com/news/michael-brown-shooting-vigil-for-dead-teen-turns-violent/.

Center for Domestic Preparedness. “Managing Civil Actions in Threat Incidents.” In *Command Student Manual*. Washington, DC: U.S. Department of Homeland Security, 2007.

Chan, Serena. “Complex Adaptive Systems.” Massachusetts Institute of Technology. Last modified November 6, 2001. http://web.mit.edu/esd.83/www/notebook/Complex%20Adaptive%20Systems.pdf.

City of Boston. “39 Arrested during World Series Celebration.” City of Boston. October 28, 2004. http://www.cityofboston.gov/news/Default.aspx?id=2354.

City of Keene. “Police Log.” October 18, 2014. http://www.ci.keene.nh.us/node/90805.

CNN. “Baltimore Riot.” Accessed October 27, 2015, http://cnnuslive.cnn.com/Event/Baltimore_Riot?Page=0.

College of Policing. “Command.” Accessed August 7, 2015. https://www.app.college.police.uk/app-content/public-order/command/.

“Complexity Science: 2 Complexity Theory.” YouTube video. Posted by “Complexity Academy.” April 18, 2014. https://www.youtube.com/watch?v=P00A9IZ7Pog&feature=youtube_gdata_player.

“Complexity Science: 7 Complex Adaptive Systems.” YouTube video. Posted by “Complexity Academy.” May 14, 2014. https://www.youtube.com/watch?v=rl0yFwcGx_o

Cooper, Steve, and Kimberly Bookman. “84 Arrested after Keene Riots, More Arrests to Come.” WHDH. December 1, 2014. http://www.whdh.com/story/26834201/84-arrested-after-keene-pumpkin-riots-more-arrests-to-come.

Cronin, Patrick, and Stephen Reicher. “A Study of the Factors that Influence How Senior Officers Police Crowd Events: On SIDE Outside the Laboratory.” *British Journal of Social Psychology* 45, no. 1 (March 2006): 175–96. doi: 10.1348/014466605X41364.

csi. “Complex Organisation.” Accessed January 10, 2016. http://www.csysi.co.uk/?page_id=32.

Discovery.com. “How Riots Behave Like Forest Fires.” August 10, 2011. http://news.discovery.com/human/london-riots-psychology-pattern-wildfires-110810.htm.

Eidelson, Roy J. “Complex Adaptive Systems in the Behavioral and Social Sciences.” *Review of General Psychology* 1, no. 1 (March 1997): 42–71. doi:10.1037/1089-2680.1.1.42.

ESPN. “One Killed in Boston’s Patriots Celebration.” ESPN. February 3, 2004. http://sports.espn.go.com/nfl/playoffs03/news/story?id=1725220.

Farragher, Thomas, and David Abel. “Postgame Police Projectile Kills an Emerson Student.” Boston.com. October 22, 2004. http://www.boston.com/sports/baseball/redsox/articles/2004/10/22/postgame_police_projectile_kills_an_emerson_student/?page=full.

FEMA. “ICS Organizational Chart.” January 11, 2015. https://training.fema.gov/emiweb/is/icsresource/assets/icsorganization.pdf.

“Ferguson Mayor: There’s No Racial Divide Here.” MSNBC video “Live with Tamron Hall.” August 19, 2014. http://www.msnbc.com/newsnation/watch/ferguson-mayor--theres-no-racial-divide-here-319506499946.

“Ferguson, Missouri: Inside an American City under Siege.” ABC News video. Accessed October 12, 2015. 3:50, http://abcnews.go.com/Nightline/video/ferguson-missouri-inside-american-city-siege-25032337.

“Ferguson Protesters Flip, Set Fire to Police Car.” YouTube video. Posted by “USA Today.” November 25, 2014. https://www.youtube.com/watch?v=xejymucKmPw.

FinnaRageTV. “The Anticipation Is Real.” October 16, 2014, http://finnaragetv.com/post/100168486002/the-anticipation-is-real-keene-state-see-you.

Fitzgerald, Sheila. *Police Brutality: Opposing Viewpoints*. New York: Greenhaven Press, 2007.

Flamm, Michael W. *Law and Order Street Crime, Civil Unrest, and the Crisis of Liberalism in the 1960s*. New York: Columbia University Press, 2005.

Freeman. Gregory, and Robert Schroeder. *Social Media Exploitation: An Assessment*. Monterey, CA: Naval Postgraduate School, 2014.

Furlong, John, and Douglas Keefe. *The Night the City Became a Stadium: Independent Review of the 2011 Vancouver Stanley Cup Playoffs Riot*. Vancouver, British Columbia: Government of British Columbia, 2011. http://www2.gov.bc.ca/assets/gov/law-crime-and-justice/about-bc-justice-system/inquiries/report.pdf.

Geron, Stephen M. “21st Centruty Strategies for Policing Protests: What Major Cities’ Responses to the Occupy Movement Tell Us about the Future of Police Response to Public Protest.” Master’s thesis, Naval Postgraduate School, 2014.

Gillham, Patrick F. “Securitizing America: Strategic Incapacitation and the Policing of Protest Since the 11 September 2001 Terrorist Attacks.” *Sociology Compass* 5, no. 7 (July 2011): 636–52. doi: 10.1111/j.1751-9020.2011.00394.x.

Gleick, James. *Chaos: Making a New Science.* New York: Viking, 1987.

Goldenberg, Jacob, Barak Libai, and Eitan Muller. “Talk of the Network: A Complex Systems Look at the Underlying Process of Word-of-Mouth.” *Marketing Letters* 12, no. 3 (August 2001): 211–217.

“Grand Jury Decides Not to Indict Officer Darren Wilson in Shooting Death of Michael Brown.” YouTube video. Posted by “PBS News Hour.” November 24, 2015. https://www.youtube.com/watch?v=EuupBHUGbYo

Heylighen, Francis, and Donald Campbell. “Selection of Organization at the Social Level: Obstacles and Facilitators of Metasystem Transitions,” *World Futures: The Journal of General Evolution* (1995): 181–212. http://pespmc1.vub.ac.be/papers/SocialMST.pdf.

Hogg, Michael A., and Scott Tindale. *Blackwell Handbook of Social Psychology: Group Processes*. Hoboken, NJ: John Wiley & Sons, 2008.

Horgan, John. “From Complexity to Perplexity.” *Scientific American* (June 1995). http://www2.econ.iastate.edu/tesfatsi/hogan.complexperplex.htm.

———. *The End of Science: Facing the Limits of Knowledge in the Twilight of the Scientific Age*. Reading, MA: Addison-Wesley, 1996.

Jenkins, Jack. “Ferguson Faith Leaders Take to the Streets, March with Protestors.” ThinkProgress. August 14, 2014. http://thinkprogress.org/home/2014/08/14/3471361/faith-groups-ferguson/

Kac, Mark. “Some Mathmatical Models in Science.” *Science* 166, no. 3906 (November 7, 1969): 695–99.

“Keene State College Pumpkinfest Riot 2014.” You Tube video. Posted by “Cullen Maher.” October 18, 2014. https://www.youtube.com/watch?v=IkWoTrhDsyc.

Keesee, Tracie, and Michael J. Nila. “Fairness and Neutrality: Addressing the Issue of Race in Policing.” *Police Chief Magazine* (March 2011): 34–39. http://www.nxtbook.com/nxtbooks/naylor/CPIM0311/.

Kenny, John M., Clark McPhail, Peter Waddington, Sid Heal, Steve Ijames, Donald N. Farrer, Jim Taylor, and Dick Odenthal. *Crowd Behavior, Crowd Control, and the Use of Non-Lethal Weapons.* State College: Pennsylvania State University, 2001. http://oai.dtic.mil/oai/oai?verb=getRecord&metadataPrefix=html&identifier=ADA446472.

Kesel, Cameron. "Top 10 Most Insane Soccer Riots in History." TopTenz. May 11, 2013, http://www.toptenz.net/top-10-most-insane-soccer-riots-in-history.php.

Leibowitz, Barry."Boston Celtics Fan Died in '08 Celebration; Parents Win $3 Million Suit vs. City." CBS News. June 18, 2010. http://www.cbsnews.com/news/boston-celtics-fan-died-in-08-celebration-parents-win-3-million-suit-vs-city/.

Letizia, Jim. "Police Admit Crowd Control Mistakes Following OSU National Title Win." WCBE. March 6. 2015, http://wcbe.org/post/police-admit-crowd-control-mistakes-following-osu-national-title-win.

Lewin, Roger. *Complexity: Life at the Edge of Chaos.* New York: MacMillan, 1992.

Lippmann, Rachel. "Four Days on, Activists Look for Ways to Channel Frustration over Michael Brown's Death." St. Louis Public Radio. August 12, 2014. http://news.stlpublicradio.org/post/four-days-activists-look-ways-channel-frustration-over-michael-browns-death.

Lorenz, Edward. *The Essence of Chaos*. Seattle: University of Washington Press, 1993.

Masterson, Mike. "Crowd Management Adopting a New Paradigm." *FBI Law Enforcement Bulletin* 81, no. 8 (August 2012): 1–6.

Mattingly, David. "Outsiders Blamed for Inciting Violence in Ferguson." 22WWLP. August 19, 2014. http://wwlp.com/2014/08/19/outsiders-blamed-for-inciting-violence-in-ferguson/.

McDowell, Kenneth V. "Violations of Personal Space." *Canadian Journal of Behavioural Science* 4, no. 3 (1972): 210.

"Michael Brown Shooting Scene in Ferguson, Mo.!" YouTube video. Posted by "Harry Williby." August 16, 2014. https://www.youtube.com/watch?v=SDNIy056DNc.

Moffit, Kelly. "How Social Media Is Playing a Role in Ferguson." *St. Louis Business Journal*. August 13, 2014. http://www.bizjournals.com/stlouis/blog/2014/08/how-social-media-is-playing-a-role-in-ferguson.html

Schreiber, Sara. "Tools of the Riot Control Trade." *Law Enforcement Technology* 36, no. 9 (September 2009): 74–79.

Murphy, Shelly. “Snelgrove Family Settles Wrongful Death Suit.” Boston.com. July 14, 2006. http://www.boston.com/news/local/massachusetts/articles/2006/07/14/snelgrove_family_settles_lawsuit/.

Nagy, Melanie. “Riots Erupt in Vancouver after Canucks Loss.” CBC News. June 15, 2011. http://www.cbc.ca/news/canada/british-columbia/riots-erupt-in-vancouver-after-canucks-loss-1.993707.

Narr, Tony, Jessica Toliver, Jerry Murphy, Malcolm McFarland, and Joshua Ederheimer. *Police Management of Mass Demonstrations: Identifying Issues and Successful Approaches*. Washington, DC: Police Executive Research Forum, 2006.

“Pittsburg G20 Protestors Use Dumpsters Bricks Police Use Sound Weapons Tear Gas.” YouTube video. Posted by “safenders.” September 24, 2009. https://www.youtube.com/watch?v=WyQBqOxgNN8.

“Police Pepper Spray, Tear Gas Celebrants.” YouTube video. Published by “TheColumbusDispatch.” January 13, 2015. https://www.youtube.com/watch?v=jDHuQ8pylmA.

Pumpkin Festival 2015. “History.” Accessed November 10, 2015. http://www.pumpkinfestival2015.org/index.php/history/.

“Pumpkin Festival Riot: Dozens Injured, Arrested near College in New Hampshire.” YouTube video. Posted by “Gloria Everhart.” October 19, 2014. https://www.youtube.com/watch?v=LWvD_geg9j4.

Ramo, Joshua Cooper. *The Age of the Unthinkable: Why the New World Disorder Constantly Surprises Us and What We Can Do about it*, 1st ed. New York: Little, Brown, 2009.

“Red Sox Master Video.” Compact Disc Video. Massachusetts State Police Crime Scene Services. 2004.

Rodolico, Jack. “Is Party Company ‘FinnaRage’ To Blame For Keene Riots?” NPR New Hampshire. October 20, 2014. http://nhpr.org/post/party-company-finnarage-blame-keene-riots.

Roseliep, Will. “Boston Police Commissioner William Evans on the Need for Mutual Respect.” WGBH News. January 13, 2015. http://wgbhnews.org/post/boston-police-commissioner-william-evans-need-mutual-respect.

Rosser, J. Barkley, Jr. “On the Complexities of Complex Economic Systems.” *Journal of Economic Perspectives* 13, no. 4 (November 1, 1999): 169–92.

The Ruckus Society. “Mission & History.” December 20, 2015. http://ruckus.org/about-us/mission-history/.

Sagarin, Rafe. “Decentralized.” Adaptable Solutions. Accessed December 13, 2015, http://adaptablesolutions.org/.

———. *Learning from the Octopus: How Secrets from Nature Can Help Us Fight Terrorist Attacks, Natural Disasters, and Disease*. Jackson, TN: Basic Books, 2012.

———. “The Rules of Adaptability.” YouTube video. January 18, 2013. https://www.youtube.com/watch?v=ZOakkaEK5QM&list=PLLqo3zIxhSEIdE-93urRbfsC6ewcsMA8R&index=5.

Sanders, Katie. “Ferguson, Mo., Has 50 White Police Officers, Three Black Officers, NBC’s Mitchell Claims.” PunditFact. August 17, 2014, http://www.politifact.com/punditfact/statements/2014/aug/17/andrea-mitchell/ferguson-police-department-has-50-white-officers-t/.

Sarin. “Bodyhammer: Tactics and Self-Defense for the Modern Protester.” Accessed December 13, 2015. http://it.stlawu.edu/~quack/shieldbook.pdf

Seattle.gov. “World Trade Organization Protests in Seattle.” Accessed February 26, 2016. http://www.seattle.gov/cityarchives/exhibits-and-education/digital-document-libraries/world-trade-organization-protests-in-seattle.

Shalby, Colleen, and Joshua Barajas. “Here’s the Real Reason People in Baltimore Are Protesting.” PBS NewsHour. May 1, 2015. http://www.pbs.org/newshour/rundown/freddie-grays-death-baltimore-community-speaks-citys-future/.

Shaughnessy, Dan. “YES!!!” Boston.com. October 28, 2004. http://www.boston.com/sports/baseball/redsox/articles/2004/10/28/yes/.

Shellman, Steve, Michael Covington, and Marcia Zangrilli. “Sentiment & Discourse Analysis:Theory, Extraction and Application.” In *Socio-Cultural Analysis with the RSI Paradigm*. Edited by Charles Ehlschlaeger, 66–82. Boston: SMA Publicadtions, 2014. doi: 10.13140/2.1.3449.0241.

“Shocking Video of Tactical Unit Getting Fired upon, Top Cops Explains.” YouTube video from The McGraw Show. Posted by “KTRS550TV.” August 22, 2104. https://www.youtube.com/watch?time_continue=128&v=g73bb0M2IcE.

Snowden, Dave. “Everything Is Fragmented—Complex Adaptive Systems at Play.” *KMWorld Magazine* 17, no. 10 (November 1, 2008). http://www.kmworld.com/Articles/News/News-Analysis/Everything-is-fragmented-Complex-adaptive-systems-at-play-51363.aspx.

Snowden, David J., and Mary E. Boone. “A Leader’s Framework for Decision Making.” *Harvard Business Review* 85, no. 11 (2007): 68.

Social Psychology Network. “Historical Figures in Social Psychology.” Accessed January 16, 2015. http://www.socialpsychology.org/social-figures.htm.

Stacey, Ralph D. *Complexity and Group Processes: A Radically Social Understanding of Individuals*. New York: Brunner-Routledge, 2003.

Stott, C., J. Hoggett, and G. Pearson. “‘Keeping the Peace’: Social Identity, Procedural Justice and the Policing of Football Crowds.” *British Journal of Criminology* 52, no. 2 (March 1, 2012): 381–99. doi: 10.1093/bjc/azr076.

Systems Theory and Modeling/ “Why Study Systems?” Accessed September 8, 2015. http://sep.csumb.edu/esse21/concepts.html.

Tajfel, Henri. *Social Identity and Intergroup Relations*. New York: Cambridge University Press, 2010.

Tesson, Karen June. “Chaos Theory, Complexity Theory and Emergence.” Inclusional Research Forum and Learning Space. Accessed August 22, 2015. http://www.inclusional-research.org/comparisons4.php

Tunnicliffe, Kim. “Police Make Arrests during Boston Protest.” CBS Boston. December 13, 2014. https://embed.radio.com/clip/58699957/?ref_url=http%3A%2F%2Fboston.cbslocal.com%2F2014%2F12%2F13%2Flarge-protest-expected-saturday-on-boston-common%2F&station_id=481&rollup_ga_id=UA-2438645-53&ads_ga_page_tracker=UA-17434257-42.

U.S. Department of Homeland Security. *National Incident Management System*. Washington, DC: U.S. Department of Homeland Security, December 2008.

U.S. Department of Justice. *After-Action Assessment of the Police Response to the August 2014 Demonstrations in Ferguson, Missouri*. Tallahassee, FL: Institute for Intergovernmental Research, 2015. https://www.hsdl.org/?abstract&did=786908&fromemail=1.

———. *Department of Justice Report Regarding the Criminal Investigation into the Shooting Death of Michael Brown by Ferguson, Missouri Police Officer Darren Wilson*. Washington, DC: U.S. Department of Justice, March 4, 2015. http://www.justice.gov/sites/default/files/opa/press-releases/attachments/2015/03/04/doj_report_on_shooting_of_michael_brown_1.pdf.

———. *Investigation of the Ferguson Police Department*. U.S. Department of Justice, March 4, 2015. http://www.justice.gov/sites/default/files/opa/press-releases/attachments/2015/03/04/ferguson_police_department_report.pdf.

Warrior Publications. “Warrior Crowd Control & Riot Manual.” Accessed February 27, 2016. https://archive.org/details/WarriorCrowdControlRiotManual.

Wollman, Lauren. “Qualitative Research.” Naval Postgraduate School video. Summer 2012. https://www.chds.us/coursefiles/research/lectures/research_qualitative_methods/player.html.

———. “Research Paradigms.” Naval Postgraduate School video. Accessed February 5, 2015. https://www.chds.us/coursefiles/research/lectures/research_paradigms/player.html.

Wolfram MathWorld. “Cellular Automaton.” Accessed September 5, 2015. http://mathworld.wolfram.com/CellularAutomaton.html.

Wolfram, Stephen. *A New Kind of Science.* Champaign, IL: Wolfram Media, 2002.

Wood, Lesley J. *Direct Action, Deliberation, and Diffusion: Collective Action after the WTO Protests in Seattle*. New York: Cambridge University Press, 2012.

Woods, David D., and Matthieu Branlat. “Basic Patterns in How Adaptive Systems Fail.” In *Resilience Engineering in Practice*. edited by Erik Hollnagel, Jean Paries, David D. Woods, and John Wreathall, 127–141. Burlington, VT: Ashgate, 2011.

Zhao, Li, Guang Yang, Wei Wang, Yu Chen, J. P. Huang, Hirotada Ohashi, and H. Eugene Stanley. “Herd Behavior in a Complex Adaptive System.” *Proceedings of the National Academy of Sciences* 108, no. 37 (September 13, 2011): 15058–63. doi: 10.1073/pnas.1105239108.

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